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The Comparative External Morphology and Systematics of the Neotropical Parasitic Fig Wasp Genus *Idarnes* (Hymenoptera: Torymidae)

Gordon Gordh

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The Comparative External Morphology and Systematics of The Neotropical Parasitic Fig Wasp Genus *Idarnes* (Hymenoptera:Torymidae)[1]

Gordon Gordh[2]

ABSTRACT

The external morphology of the parasitic fig wasp genus *Idarnes* is examined and compared to more primitive and advanced hymenopterous forms. Several secondary features, noticed by earlier workers, have been named in the present paper. These features include setal tracts in the forewing and mesosomal apodemes of the female.

In spite of its distinctive appearance, *Idarnes* has never been properly characterized. Therefore, the genus has been redefined and a neotype designated. Eleven species are described as new and numerous species erroneously included earlier in *Idarnes* are discussed.

Although *Idarnes* has been considered pantropical, the present work develops the hypothesis that it is exclusively neotropical. Moreover, evidence is presented which suggests *Idarnes* is found exclusively associated with the subgenus *Urostigma*. Ramírez has demonstrated that a high degree of specificity exists between species of agaonid pollenator and *Ficus* host. Data collected throughout México and Central America indicate a similar pattern exists for *Idarnes*. However, it is uncertain whether the specificity exhibited by *Idarnes* is connected to the pollenator, host fig, or both.

INTRODUCTION

Since its description in 1843 by Francis Walker, the genus *Idarnes* has never been properly characterized, although numerous identifications of *"Idarnes carme"* have been made (Wolcott, 1951; Butcher, 1964; cf. remarks of Burks, 1969). This study is intended to provide a firm systematic foundation for *Idarnes* and to elucidate its external morphology.

Of the earlier workers, Mayr (1885, 1906) probably came closest to guessing the true identity of *Idarnes*. Unfortunately, the original generic description of *Idarnes* is so vague that Mayr supposed his material to be new and erected the genus *Tetragonaspis* for it in spite of his suspicions about *Idarnes*. Subsequent taxonomic studies (Ashmead, 1904; Girault, 1913) only obscured the issue. Aside from an occasional remark (Risbec, 1951; Joseph, 1964, 1967; Wiebes, 1966b, 1968, 1970; Hill, 1967a; Burks, 1969), *Idarnes* has remained essentially untouched systematically.

Nonetheless, *Idarnes* represents the largest, most conspicious element of the neotropical fauna of fig wasp parasites. Although other parasitic genera are found, they are never collected in the diversity or abundance of *Idarnes*.

ACKNOWLEDGMENTS

Numerous individuals were in part responsible for bringing this work to fruition. Mr. William Ramírez provided much of the material studied from his personal collection of Central American figs and fig wasps; Dr. P. D. Ashlock (University of Kansas) gave many helpful suggestions regarding a cladistic analysis of the group; Dr. R. E. Beer (University of Kansas) aided in collecting material in México during the summer of 1970; and Dr. B. D. Burks of the United States

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National Museum lent material from which a neotype was designated. Dr. J. T. Wiebes (Rijksuniversiteit, Leiden) had the onerous task of comparing much of the material with that of the Mayr collection and gave several taxonomic suggestions. Professor C. D. Michener (University of Kansas) has offered encouragement, suggestions, and a critical evaluation of the entire project. To Professor J. H. Camin (University of Kansas) I am deeply indebted for the generous loan of equipment, facilities, and space during the entire gestation of this revision.

Linda Gordh typed rough drafts of the manuscript and rendered much clerical assistance.

MATERIALS AND METHODS

The material studied came from three sources: collections by the author from México during the summers of 1969 and 1970; material provided by William Ramírez from Central America; and representatives of previously described species provided by J. T. Wiebes.

Collecting in México was by the methods described by Ramírez (1970b). For a tabulation of Central and North American host trees, *Blastophaga* pollinators, and associated *Idarnes* parasites, see Table 1. For each collection, ripened syconia of the *Ficus* were preserved in 70% alcohol; branches, including young figs and leaves, were pressed. In addition, samples of all fig species collected during 1970 were halved, photographed, and close-up photographs of branches taken. Identification of host figs was based on the classification of Standley (1917). When applicable, the work of DeWolf (1960) was consulted; Condit's (1969) work also proved useful. Plant material collected during the summer of 1969 was retained by Ramírez; plant material collected during the summer of 1970 is retained by the author.

All wasp material was collected into 70% alcohol. Associated pollinators (agaonids) were given to Ramírez and Wiebes, while voucher specimens of torymids collected during the 1970 trip were given to Professor Wiebes. The bulk of the material remained with the author. For the deposition of types, see Table 2.

Specimens were dissected in depression slides filled with 70% alcohol. Dissections were made with *minuten nadeln* hooks embedded in heat-treated glass rods. The following parts were separated from intact female wasps: antennae, head, pro-, meso-, and metathoracic legs, pronotum, mesosternum, labiomaxillary complex, gaster and wings. Parts separated from intact male wasps included antennae, legs and occasionally the gaster. When each dissection was completed, wings and the labiomaxillary complex were mounted on a slide in Hoyer's medium. Other structures were cleared in 10% KOH at 50° C for 12-16 hours, depending upon size and sclerotization. The parts were then transferred to 70% alcohol for several hours and subsequently mounted in Hoyer's. Material sent to the U.S. National Museum of Natural History and many paratypes were mounted in Canada balsam.

After Hoyer's medium slides were dried for several days at 50° C (with the aid of a slide warmer), each coverslip was sealed with Zut's Ringing Medium. This procedure proved excellent for preventing deterioration of the mount due to evaporation of water from the Hoyer's.

Illustrations were prepared with a microprojector and a binocular phase contrast Zeiss microscope with drawing tube attachment.

THE EXTERNAL MORPHOLOGY OF *IDARNES*

I. *Female Head* (Figs. 1-3)

Based upon the axis of the gnathal appendages and the position of the occipital foramen, the cranium of female *Idarnes*

may exhibit two distinct conditions: it may be prognathous (as in *I. bucatoma*) or more generally hypognathous (as in *I. barbigera, I. galbina*). The shape of the cranium is highly variable, ranging from elongate *(I. bucatoma)* to round *(I. galbina)*.

The sculpture of the head capsule is also variable, depending upon the degree of sclerotization. Species such as *I. galbina* have lightly sclerotized heads and hence are nearly smooth; *I. obtusifoliae* females have honeycomb-like sculpturing which results in heavy sclerotization.

When viewed from above, 3 triangularly arranged ocelli are visible; when viewed from the front, the position of the anterior ocellus is variable, ranging from the level of the upper third of the compound eyes to the crest of the vertex. Position of the ocelli seems correlated with the axis of the cranium: species with prognathous heads have ocelli located higher on the vertex than do species with hypognathous heads.

The epicranial suture represents a cardinal landmark of the generalized insect head. Within the Hymenoptera an epicranial suture has been identified in the Symphyta (Pergidae), some braconids, and evanoids. Michener (1944b) indicated the suture was not present in bees.

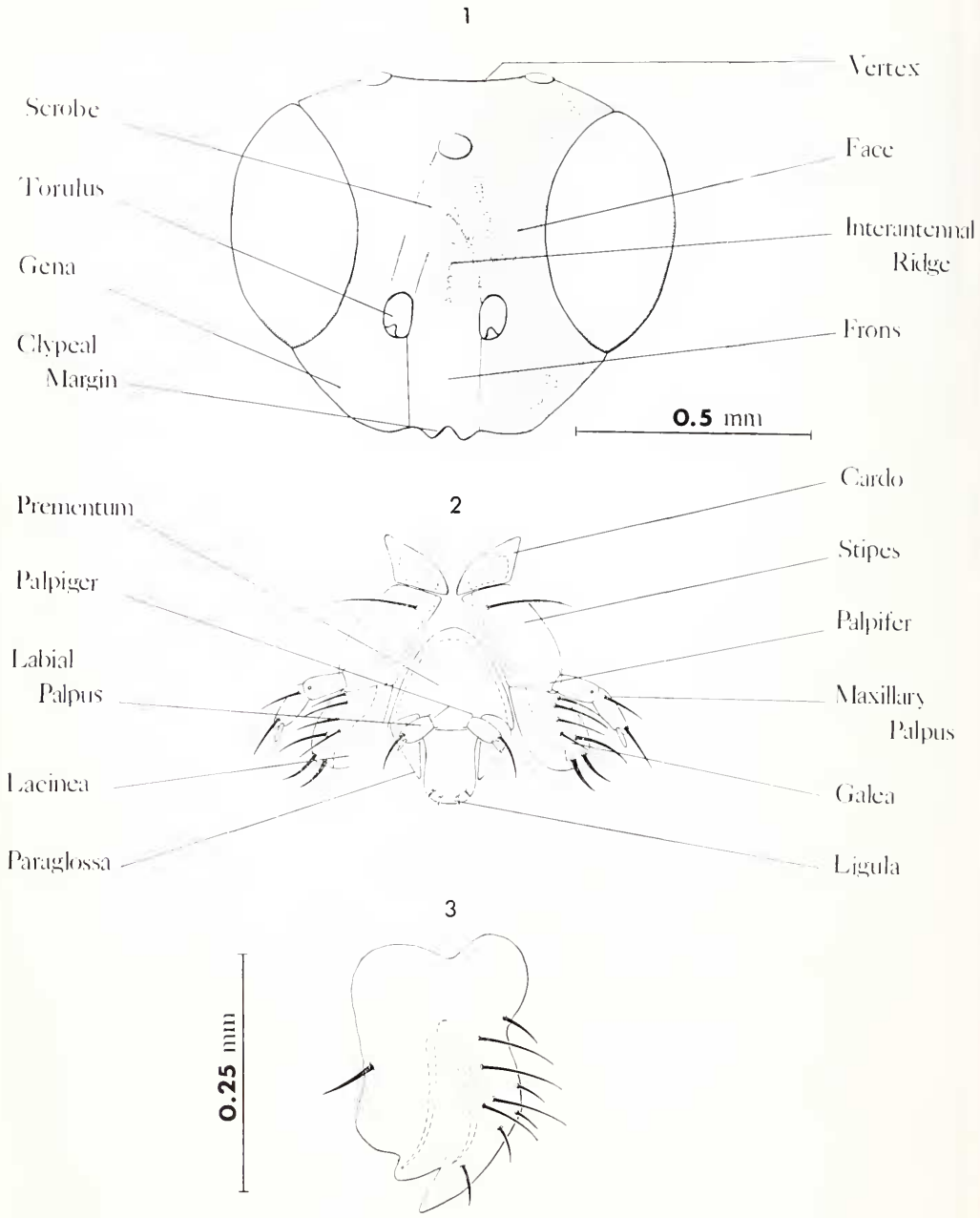
The epicranial suture is not evident in *Idarnes* or any other chalcid examined morphologically. As a consequence standard regions of the cranium are poorly defined and homology with more primitive insect heads is difficult. Michener (1944b) recognized this problem in bees and created artificial boundaries for the area between the anterior ocellus and toruli. He applied the term "supra-antennal" which is noncommital with regard to homology; however, this term has not been retained in the present work because the scrobal cavity and interantennal ridge are well defined and are more familiar terms.

Immediately lateral to the scrobal cavity and adjacent to the compound eye inner margin is another ill-defined region termed the "face" in the present work. It is bounded by imaginary transverse lines extending from the anterior ocellus dorsally, and the toruli ventrally. The region is called paraocular by Michener (1944b), parafrontal by Pratt (1940) and parietal by Bucher (1948). The face and scrobal cavity together are regarded as the frontovertex by some chalcid taxonomists. However, because the scrobe is so well defined in *Idarnes* it is again useful to separate these regions terminologically.

The compound eyes of *Idarnes* are lateral to the face. They vary in shape, ranging from round *(I. galbina)* to oval *(I. carme)*, but are never emarginate. The eyes are never setose in *Idarnes*, though this characteristic is common in other chalcidoids such as *Aphytis* (Aphelinidae). Many Hymenoptera (some braconids, evanoids, vespids, and bees) have a circumocular sulcus that circles the compound eye. If the sulcus is present in *Idarnes*, it must coincide with the margin of the eye itself since no conspicuous ring has been observed. Some chalcids (e.g., *Brachymeria*, Chalcididae) bear a distinct line of favose punctations which surround the eye margin. However, this condition is also absent from *Idarnes*.

Heads cleared in KOH or bleach reveal the presence of a large, well defined ocular sclerite. This feature has been found in all chalcids examined (including representatives of 12 families). Presumably the ocular sclerite supports the compound eye and provides a shelf upon which the eye rests. The ocular sclerite of *Idarnes* is peninsulate along the inner margin, but the function of this feature is unknown.

The gena (= malar space) is immediately beneath the compound eye. When the head is viewed in lateral aspect it is



FIGS. 1-3. **1,** Head of *Idarnes* female, anterior aspect; **2,** labiomaxillary complex of *Idarnes* female, external aspect; **3,** left mandible of *Idarnes* female, inner aspect.

bounded dorsally by the eye, ventrally by the pleurostome, and anteriorly and posteriorly by imaginary lines extending from the lateral margins of the compound eye to the mandibular articulations. In most chalcids a subocular suture (= malar sulcus) bisects the gena, extending from the ventral margin of the eye to the pleurostome. In many encyrtids, eupelmids, and pteromalids the suture is bold and pre-

sumably serves as a secondarily developed reinforcement for the cranium. In *Monodontomerus* spp. also it is well developed, but all species of *Idarnes* lack the suture. In the related genus *Critogaster* the subocular suture is incipient, represented only by a weak, dark, incomplete line.

The insertion of the antennae in *Idarnes* ranges from the midline of the compound eyes to their ventral margins. Moreover, the toruli may be nearly contiguous *(I. bucatoma)* or separated by one to several times the diameter of a single torulus *(I. camini)*. The antennal suture circling the torulus is well defined. The antennifer is variable, being conspicuous in some species *(I. simus)* and reduced in others *(I. galbina)*. Between the toruli and anterior ocellus, a shallow depression (scrobe) which receives the scapes when the antennae are in repose is always present. The scrobe is divided by a mesal interantennal ridge of variable length and height. When well developed, it creates two distinct channels which merge at the anterior ocellus.

Since the epicranial and frontal sutures are absent from *Idarnes,* the boundaries of the frons are not certain. The frons is taken to be a region below an imaginary transverse line below the toruli and between perpendicular lines extending from the outer margin of each torulus to the pleurostome.

The anterior tentorial pits are minute and can be located only with a compound microscope by tracing the course of the anterior tentorial arms to the surface of the head. The epistomal and subgenal sutures are absent from *Idarnes*. Thus, the boundary separating the ventral margin of the frons from the dorsal margin of the clypeus is arbitrary. For the purpose of the present paper, it is taken to be an imaginary transverse line between the anterior tentorial pits. Bucher (1948) noted *M. dentipes* and James (1926) indicated *Harmolita graminicola* have epistomal and subgenal sutures.

The labrum of *Idarnes* consists of a membranous flap concealed beneath the clypeus. This condition seems common to most chalcids though some species of *Leucospis* exhibit a lightly sclerotized retractile sclerite and in *Perilampus* this sclerite resembles a comb.

The mandibles (Fig. 3) of *Idarnes* are highly sclerotized, bi- or tri-dentate. The toothed margin may be sharply *(I. flavicollis)* or weakly *(I. galbina)* incised. Mandibles bear 2 hollow, internal, cone-like cavities extending into the primary and secondary teeth. The third tooth of tri-dentate species lacks such a feature. These cavities seem universal in the Chalcidoidea. In some Pteromalidae (*Pachycrepoideus vindemiae, Pteromalus* spp.) and Perilampidae (Perilampus spp.) the left mandible may have 3 cavities. However, in all cases the function of this adaptation is unknown.

The maxillae and labium (Fig. 2) are bound together by membrane, forming the labiomaxillary complex. Maxillary components include cardo, stipes, galea, lacinea, and segmented palpus. The cardo shape is variable, but it always flexes mesally along the posterior margin of the elongate stipes, except in isolated instances (some individuals of *I. micheneri*) where it is fused to the stipes. Each stipes characteristically bears a basal acuminate seta. The maxillary palpus arises from the antero-lateral margin of the stipes and consists of a proximal palpifer and 2 distal segments. Lengths of the palpifer and palpal segments are variable and the palpifer and basal palpal segment may be fused. The basal segment bears a scolopophorous sensillum at the distal end and the terminal segment is characterized by sensory spines and acuminate setae. The galea and lacineae are membranous, enveloping the ligula and paraglossae. These modifica-

tions contrast sharply with the condition found in aculeate Hymenoptera (Matsuda, 1965) but conform to other chalcidoids.

The labium consists of a medio-distal ligula (fused glossae), prementum, paraglossae, and lateral labial palpi. The ligula is surrounded by a crown of pilus dentilae (flattened pronged setae) and is arched sharply forward, bearing 2 or 4 sensory pegs along its anterior margin. (Sensory pegs along the margin of the ligula seem characteristic of all chalcidoids, though the number varies considerably among species. Encyrtids such as *Comperia merceti* have as many as 10 pegs; 2 pegs seems to be the minimum number.) The ligula is broadly attached to the prementum (which is always larger than the ligula in *Idarnes*), which also bears the labial palpi on the distal margin. The 1-segmented labial palpi are always shorter than the maxillary palpi, with the palpiger irregular. The apex of each palpus bears a long, acuminate seta, and there is often a long basal one.

The paraglossae arise from the prementum lateral to the labial palpi. Each is blade-like, lightly sclerotized, and projects anteriorly along the lateral margin of the ligula. They are exceedingly difficult to see except with high magnification (> 250X). The mentum and submentum are not differentiated, a feature noted by Matsuda (1965) for other chalcidoids.

The posterior surface of the chalcid head has undergone considerable modification, making homology difficult or impossible. In *Idarnes* it may be flat or concave, depending upon the species. The occipital suture (preoccipital ridge of Michener, crassa of Ross) is inconsistently developed in the Hymenoptera and altogether lacking in *Idarnes*. Bucher (1948) indicated *Monodontomerus* bears a well developed carina he chose to call an occipital suture, but it is doubtful that this carina is homologus with the occipital suture of more primitive insects.

The dorsal margin of the occipital foramen of *Idarnes* exhibits a thickening which diminishes laterally. The post occipitial suture is poorly developed and does not circle the foramen. The dorsal thickening may contain remnants of the post occipital suture, but they have not been observed in any species of *Idarnes* yet examined.

In *M. dentipes, H. graminicola,* and most other chalcids the occipital foramen is bisected by an apodeme which originates at the posterior tentorial pits. This structure has been termed the corporotentorium, body of the tentorium, or primary tentorial bridge by various writers on Hymenoptera morphology. It is lacking from all species of *Idarnes*. Posterior tentorial arms do project from the posterior tentorial pits to the ventral margin of the foramen in *Idarnes*, but these are not fused.

The posterior tentorial pits are small and may be recognized by tracing the tentorial arms to the surface of the head. The pits are ventro-lateral to the foramen.

The sclerite which separates the foramen from the proboscidial fossa exhibits two conditions. In some species *(I. ashlocki)*, faint post occipital sutures run parallel from the posterior tentorial pits to the proboscidial fossa. The sclerite thus formed is a gula according to the definition of Snodgrass (1935). Bucher (1948) has made a similar observation for *Monodontomerus*. However, in each instance the gula has developed on a hypognathous head. Alternatively, a faint median suture may be present *(I. simus)* and extend from the ventral margin of the foramen to the proboscidial fossa. The postgenae are separated by a postgenal groove. This mesad migration of weakly developed postoccipital sutures has drawn the lateral

walls of the proboscidial fossa together thereby forming a hypostomal bridge.

II. *Female Antenna* (Fig. 4)

Antennae are either 12- or 13-segmented because there may be 1 or 2 annuli at the base of the flagellum. The first annulus is always constricted basally; the second, when present, appears to be a fragment of the first flagellomere. The annuli have been counted in numbering the flagellomeres.

Surface features of individual flagellomeres are highly variable among species, but constant intraspecifically. The most conspicuous modifications include longitudinal carinae and three forms of setae, inflexible (obdurate) setae (Figs. 25, 27, 28), flexible setae (Figs. 29, 34), and acicular setae (Fig. 26). Setal types may be distinguished on the basis of appearance when mounted under a coverslip and viewed with a low power compound microscope objective. Flexible setae are recurved, appear hollow and are often apically blunt; inflexible setae are not recurved or hollow, and are shorter than flexible setae. Acicular setae are long and transmit light in such a way as to make the base resemble the eye of a needle. Each type of seta, when present, forms a whorl around each flagellomere. These setae usually originate at the base of a flagellomere, but minute inflexible setae may, in addition, be randomly dispersed in some species. For a given species, one setal form predominates.

A club may or may not be present. When present, it is composed of the last 3 flagellomeres, and may be compact *(I. bucatoma, I. micheneri)* or loosely formed *(I. ashlocki)*. Regardless of club formation, the distal 3 flagellomeres (=clavus) always show the carinal and setal patterns found on previous segments. A nipple-like terminal protuberance is always present, although sometimes weakly developed. It bears clusters of short, thick setae and minute discoid sensilla. This feature seems to be a characteristic of the family Torymidae.

III. *Female Thorax* (Figs. 6-9)

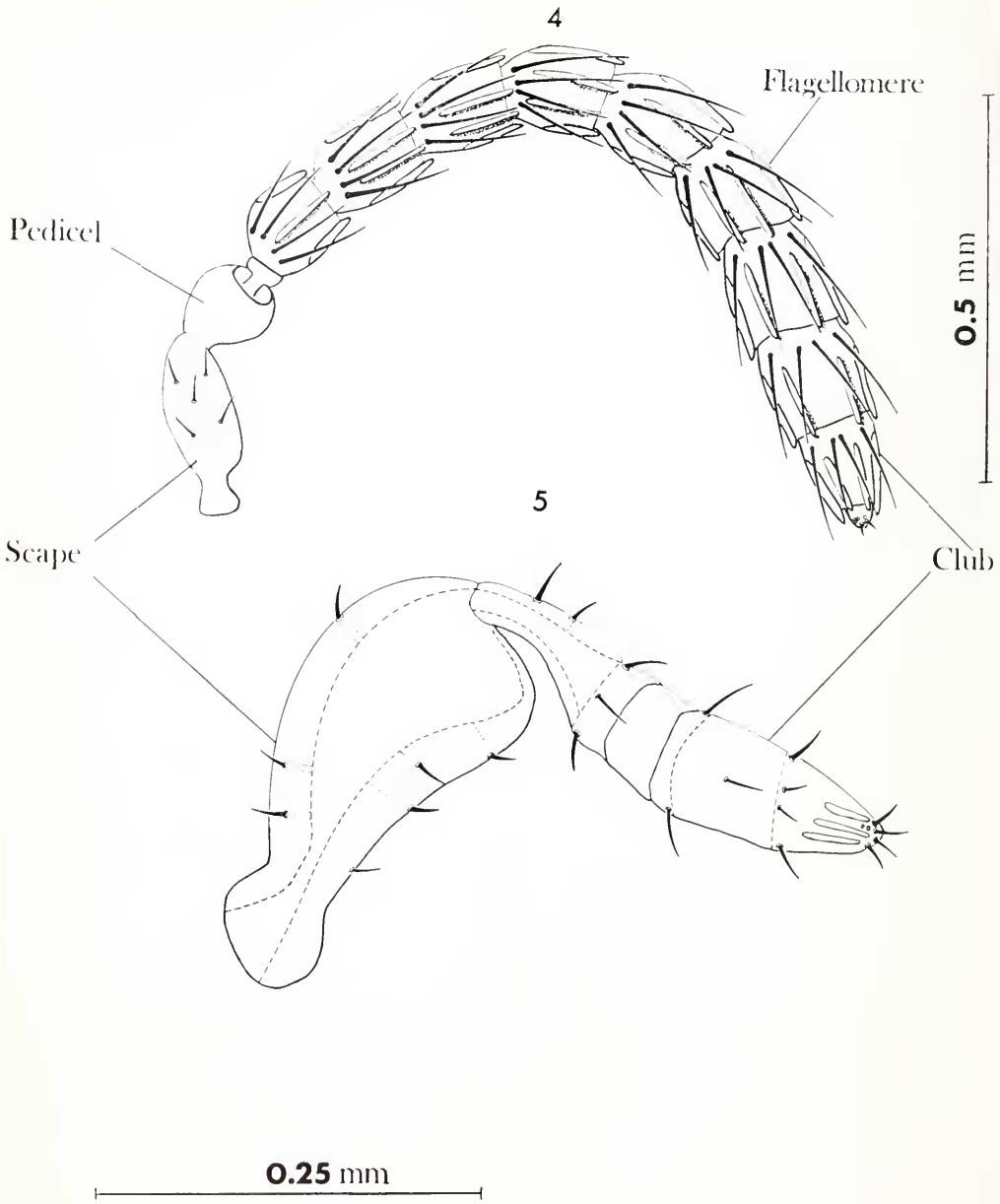
Aside from a few incomplete statements regarding specific features (cf. Compere, 1962; Compere and Rosen, 1970; Richards, 1956; Matsuda, 1960, 1970) of the pleurosternum, no attempt has been made to homologize the chalcidoid thorax with that of more primitive and advanced hymenopterous forms. Although *Idarnes* is seemingly specialized biologically, it is a member of a chalcidoid family considered to be primitive (Malyshev, 1966; Breland, 1938). Morphological features of *Idarnes* tend to bear out this hypothesis.

The central portion of the chalcidoid body (mesosoma, *sensu* Michener, 1944b) consists of four regions: pro-, meso-, metathorax and propodeum. Morphologically, the last represents the first abdominal segment which has fused with the thoracic components, a condition characteristic of all clistogastrous Hymenoptera. The term thorax will be used to refer only to the three anterior segments of the mesosoma; when the term mesosoma is used the propodeum is also included in the discussion.

The Notum (Figs. 6, 7)

The pronotum (Figs. 6, 7) of female *Idarnes* is rigid, collar-like, and envelops the anterior edge of the mesoscutum. The pronotum is not sharply angular at the anterior end, but is latero-ventrally expanded, forcing the proepisterna into ventral positions; it usually possesses the notal sculpture pattern only along the posterodorsal edge, with the remainder of the sclerite smooth or bearing distorted striations.

The mesonotum (Fig. 6) comprises the bulk of the thoracic notum. It has been

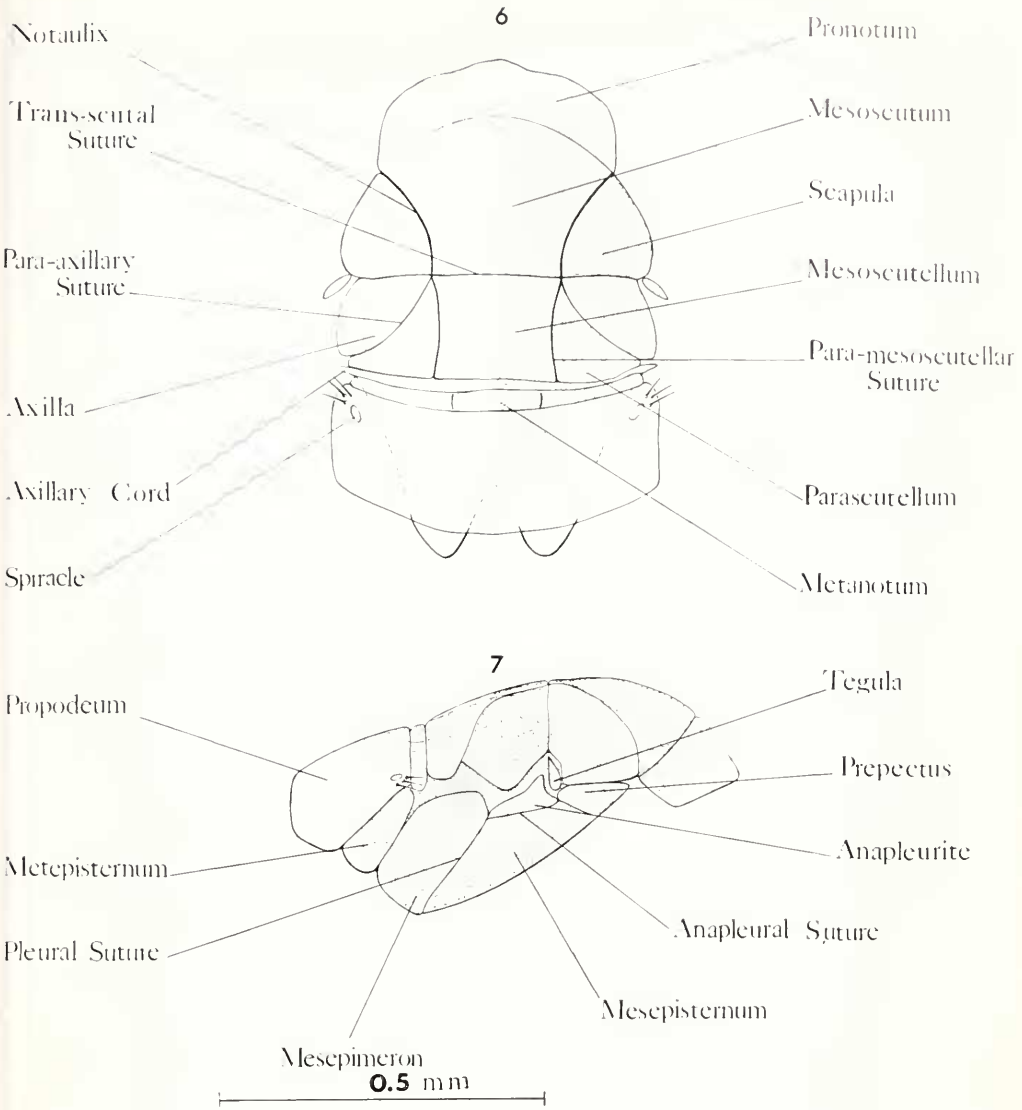


FIGS. 4-5. **4,** Left antenna of *Idarnes* female, inner aspect; **5,** left antenna of *Idarnes* male, dorsal aspect.

subdivided into 7 distinct regions, separated by sutures, sulci, and apodemes.[1]

[1] Snodgrass (1962) has indicated that the first two terms have been used interchangeably and that it is often impossible to distinguish between them. As a consequence, the term suture is used throughout the text.

Anterior-most of the mesonotal regions is the prescutum, which is not visible from a dorsal view and may be seen only when the pro- and mesosternum have been separated. The prescutum is bounded dorsally by the mesoscutum to which it is united at the transverse notal suture. In *Idarnes,*



Figs. 6-7. Mesosoma of *Idarnes* female in dorsal (6) and lateral (7) aspects.

however, this suture is poorly defined. Moreover, the prescutum represents a lightly sclerotized, pendulous lip which projects posteriorly beneath the mesoscutum and effectively forms an anterior rim that contains the dorsal longitudinal flight muscles.

The mesoscutum (in a restricted sense, including scapulae) lies immediately behind the pronotum and is bounded laterally by notaulices[2] and posteriorly by the

[2] Various authors have referred to these longitudinal inflections of the mesonotum as "parapsidal sutures." Tulloch (1929) indicated that parapsidal sutures are distinct from notaulices, with the former extending anteriorly from the scutoscutellar suture while the latter extend posteriorly from the anterior margin of the mesoscutum. Functionally, parapsidal sutures represent the site of attachment for rudimentary indirect flight muscles, while notaulices are associated with the distribution of connective tissue during metamorphosis (Daly, 1964). Some chalcids bear both structures, but *Idarnes* has only notaulices.

trans-scutal suture. The shape of the mesoscutum in *Idarnes* is constant. In lateral aspect the posterior margin is flat, but where the notaulices begin to diverge anteriorly, the mesoscutum is arched (Fig. 7). The regions lateral to the mesoscutum, bounded by the notaulices, are the scapulae.[3] In *Idarnes* these sclerites are large and constant in shape. They are bordered posteriorly by the lateral parts of the trans-scutal suture.

The trans-scutal suture of *Idarnes* is transverse and straight. The principal landmark posterior to this suture is the mesoscutellum which is characteristically quadrate. As with the scutum, the term here is used in a restricted sense, the lateral fragments being named separately for convenience. Laterally, the mesoscutellum is bounded by a secondary suture which I have chosen to call the *para-mesoscutellar suture*. Posteriorly, the mesoscutellum is bounded by a bold suture-like impression which Graham (1969) terms the frenal groove. Immediately posterior to the frenal groove and anterior to the metanotum is a narrow, transverse region termed the postscutellar zone in contradistinction to the postscutellum of Burks (1943). The postscutellar zone extends laterally to the base of the forewing and forms the axillary cord, a fact which indicates that it is a fragmentum of the scutellum.

Lateral to the mesoscutellum and posterior to the trans-scutal suture another secondary suture has been formed. Originating adjacent to the intersection of the notaulices, trans-scutal and para-mesoscutellar sutures, a *para-axillary suture*[4] extends obliquely rearward to the base of the forewing. The suture separates the axilla from a region termed the *parascutellum* by Grandi (1921). Grandi recognized the presence of the para-axillary suture, but chose to refer to it as a "rinforzo endoscheletrico della linea che separa l'ascella dal parascutello." Subsequent taxonomic studies on chalcid parasites associated with figs have illustrated this suture, but not indicated a name or its morphological significance (cf. work of Joseph, Hill, etc.). The suture separates the para-scutellum and axilla into two equal regions. Incipient para-axillary sutures exist in other families of chalcidoids, notably Eulophidae (Brothers and Moran, 1969) and Agaonidae (Grandi, 1929).

The second phragma (Fig. 6) is a large, lightly sclerotized, bilobed plate which provides attachment for the dorsal longitudinal flight muscles. In *Idarnes* the sclerite may be viewed only when the mesonotum is separated from the propodeum and metathorax, since it develops beneath the metanotum and dorsum of the propodeum. Weber (1924) and Snodgrass (1910) both believed the postphragma to be double-walled; however, it appears single-walled and arises from the metanotal antecosta.

The metathorax represents the final thoracic subdivision of the mesosoma; it is a narrow transverse band when viewed from above (the general condition in Hymenoptera), and upon closer inspection appears superficially divided into three regions.[5] The distinctness of the areas is emphasized by different sculpture patterns found on the meson and lateral regions. The meson (dorsellum of Graham, 1969)

[3] Graham (1969), in agreement with general-morphological usage, regards the entire region cephad to the scutoscutellar suture in chalcids as the mesoscutum, with development of notaulices subdividing the region into a mid- and two lateral sclerites. But since the scapulae are so distinct in many chalcidoids, it is convenient to separate them terminologically.

[4] Graham (1969) calls this the "scutello-axillar suture," a term less descriptive. The sclerotized area just behind this suture was regarded by Graham as the "Axillula." Bucher (1948) noted the presence of an incomplete suture in this region of the mesonotum of *M. dentipes*, but chose to call it "suture of the postscutum."

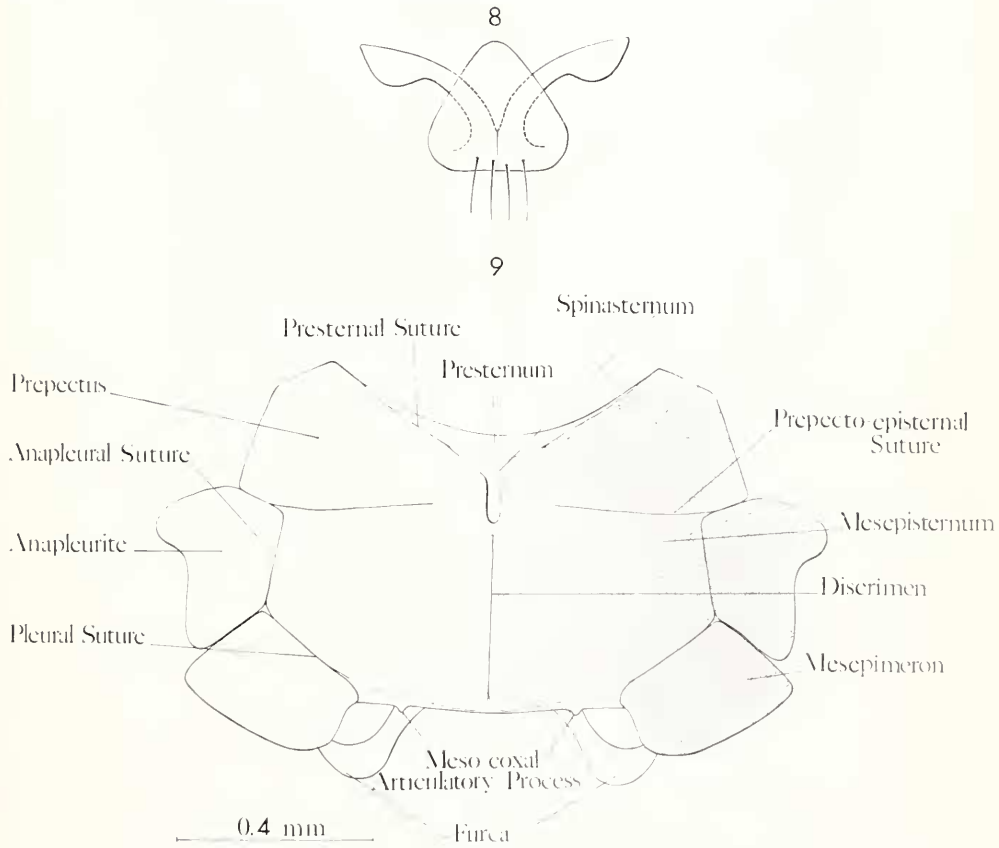
[5] Owing to the reduction of the metanotum, homologies with the mesonotum are difficult. The terms meson and lateron will be applied.

is characteristically elevated from the lateral areas (metanotum of Graham, 1969). The three regions are more or less equal in size. While plicae may be evident in some species of *Idarnes,* no longitudinal sutures are present to separate the three areas into distinct sclerites. The metanotal postphragma is obsolete.

The Pleurosternal Region (Figs. 7-9)

Several theories regarding the origin and development of the pleurosternal region of the insect thorax have been put forward. The primitive pleural region must have been membranous. To account for the origin and development of sclerotization, Heymons (1899) developed the subcoxal theory of the sternal and pleural sclerites. While most subsequent morphologists have subscribed to this concept in principle, their opinions regarding homologies of various sclerites have diverged sharply (Weber, 1924, 1928; Snodgrass, 1935; Ferris, 1940; Richards, 1956; DuPorte, 1965).

The pleurosternal region of *Idarnes* is primitive compared to that of most chalcidoids. As in other pterygotes, the prothorax is simple when compared with a wing-bearing segment. Hanna (1935) interpreted the pleuron of *Euchalcidia caryobori* (Chalcididae) to be exclusively episternal and the proepimeron to be absent. *Idarnes* conforms to this pattern, for reasons indicated below. Earlier workers sometimes regarded the episternal plates as the prosternum; however, this interpretation is untenable for *Idarnes.*



Figs. 8-9. 8, Prosternum of *Idarnes* female, ventral aspect with furca flexed cephalad; 9, mesothoracic pleurosternum of *Idarnes* female, ventral aspect with furca flexed caudad.

Idarnes lacks lateral cervical sclerites. Instead, the anterior cranial processes (Snodgrass, 1910) of the proepisterna articulate directly with the posterior surface of the head. As in other Hymenoptera, it is not possible to state conclusively if the cranial processes represent a fusion of cervical sclerites with the proepisterna or whether the processes are modifications of the anterior-most portion of the proepisterna.

The mesal surfaces of the proepisterna are flat and contiguous along their anterior ends. The proepisterna are ventral in position, seemingly having been pushed ventromesally by the expanding pronotum.

The prosternum (Fig. 8) is a small sclerite which lies immediately behind the posterior proepisternal margins and between the forecoxae. It is highly variable in shape, ranging from nearly round to trapezoidal. Superficially, the prosternum may be rugose to smooth with scattered setae projecting posteriorly.

The discrimen of the prosternum is evident and variably developed. In one species *(I. bucatoma)* it extends nearly the entire length of the sclerite; in some species it is barely evident. Internally, the prosternum bears 2 conspicuous apodemes, the prosternal furca.

Idarnes appears to retain only proepisterna, proepimera being absent. Internally a ridge extends from each cranial process rearward, running the entire length of the propleuron along its lateral margin. This ridge has been called by Snodgrass the *internal pleural ridge,* in spite of the fact that the upper ends leads to the cranial process. At the level of the apex of each strenal apophysis, the internal pleural ridge is extended further inward, forming a pleural apophysis. By definition (Snodgrass, 1935), the episternum and epimeron are separated by the pleural suture. Although the *pleural suture* is evanescent (since it is the lateral proepisternal margin), the pleural apophysis and ridge are evident.

The mesothoracic pleurosternum (Fig. 9) (= mesopectus of Compere, 1962) of *Idarnes* is large and conspicuous. The mesothoracic legs arise ventrally along the posterior edge of the mesepisterna and are mesally contiguous. The points of articulation with the mesothorax are unmistakable, and the pleural suture is quite distinct; consequently, homologizing the various mesothoracic sternal components is comparatively simple. Interestingly enough, the coxal condyles are apparently sternal in origin since they are continuous apodemes which originate along the discrimen and fuse with the posterior margin of the mesepisternum. This condition has been observed in all trichogrammatids, aphelinids and encyrtids examined morphologically.

The anterior-most region of the mesothoracic pleuron is a lightly sclerotized, nearly membranous presternum. Immediately posterior to this is the area commonly called the prepectus. An internal submarginal ridge (= presternal suture) separates the two structures.

The triangular prepectus (Figs. 7, 9) is large and not completely separated from the rest of the mesepisternum. Numerous other species of chalcidoids have the prepectus more nearly separated from the sternal plate *(Microterys, Encyrtidae).* I call the suture which separates the prepectus from the mesepisternum the *prepecto-episternal suture,* and this should not be confused with the pleural suture which lies posteriorly.

Immediately behind the prepectus is the main mesepisternal plate, which comprises the bulk of the pleural region of the mesothorax. The discrimen separates the mesepisterna midventrally. Internally, a large, conspicuous furca is evident on the posteromesal surface of the episternum. The spinasternum has fused to the epi-

sterna mesally at the anterior end of the discrimen.

The mesothoracic pleural suture is identifiable by the position of the articulatory process of the mesothoracic coxa. The coxal articulation is on the posterior edge of the mesepisternum, halfway between the mesepimeron and the discrimen. The pleural suture runs obliquely forward separating the epimeron from the episternum. Prepectus, epimeron, and episternum are moderately sclerotized and bear sculpture patterns that range from favose to lightly shagreened.

Lateral to the main mesepisternal plate is a conspicuous anapleural suture (= pleural ridge of Bucher, 1948; = sternopleural suture of Snodgrass, 1910, 1935). The sclerite lateral to this suture has been termed "epansione marginale anteriore del mesopleurum terminante nel denza della regione epimerale" by Grandi (1929) for *Blastophaga psenes*. The anapleural suture must be a secondary development and consequently the sclerite formed must be part of the mesepisternum. It is here called the anapleurite, and it arches dorsally beneath the forewing, providing a fulcrum for wing movement. The upper part of the pleural suture which leads to this fulcrum in primitive insects is absent. Here the anapleurite may have an epimeral as well as an episternal component.

The metasternum of *Idarnes* is unusual. The hind legs are latero-ventrally situated, and from a lateral view only a metepisternum is visible. The metepisternum meets the mesepimeron along the lateral thoracic wall. However, the two sclerites have not formed a suture between one another since they are readily separable upon dissection. Together, the metepisterna form a moderate sized oblique plate which confines the mesothoracic coxae posteriorly. The metepisterna extend ventrally and meet along the longitudinal central axis of the body, forming an internal keel between the hind coxae. The keel splays out laterally, forming a lightly sclerotized plate which separates the hind coxae from the longitudinal flight muscles.

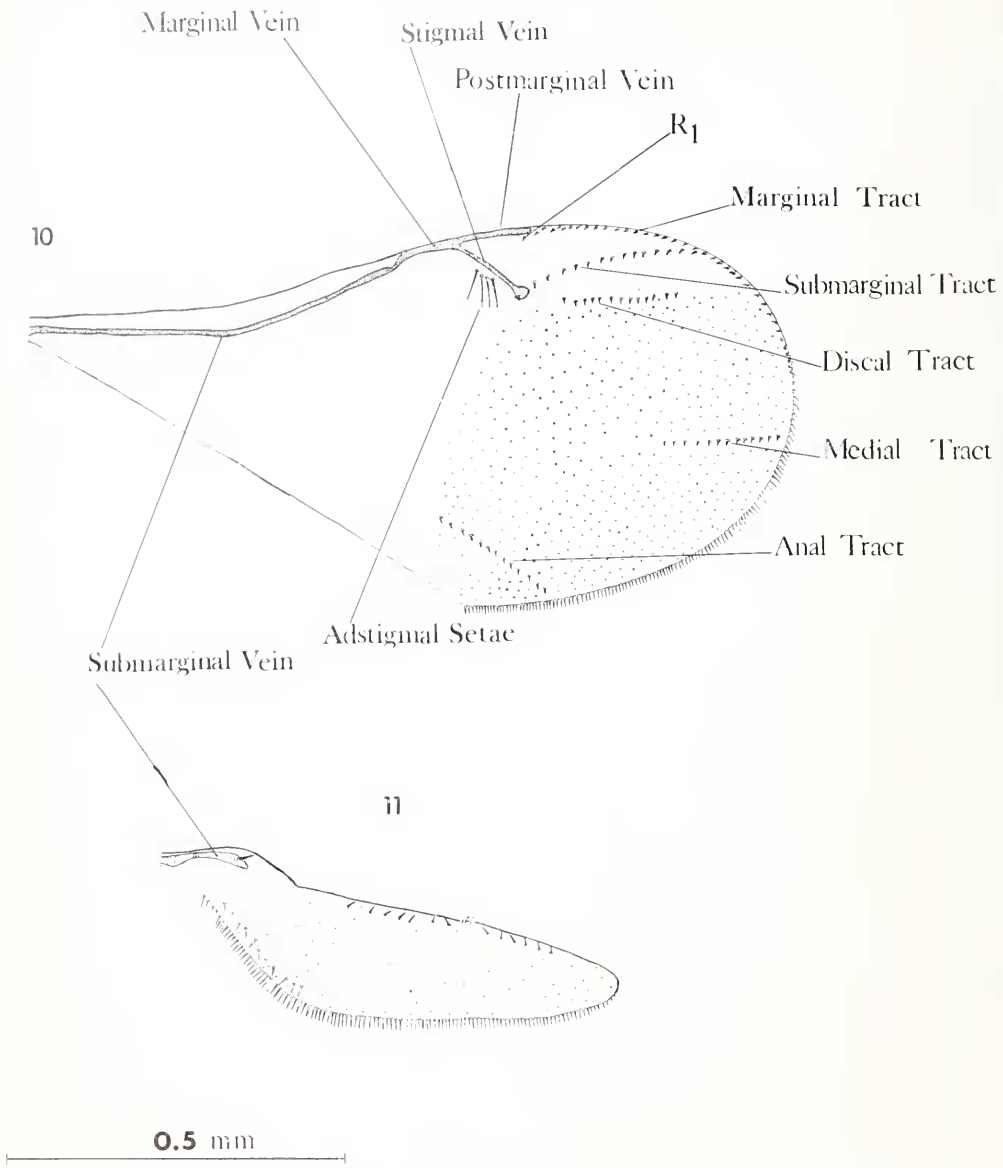
The metathoracic pleural suture (Fig. 7) originates at the metathoracic leg articulatory point (seen as a notch along the dorsal surface of the coxa) and continues obliquely forward, terminating beneath the hind wing. Immediately behind the pleural suture is the propodeum; the metathoracic epimera have been nearly obliterated. All that remains of the metepimera are two thin, transverse bands, one on each side, which converge mesally behind the metathoracic coxae and connect to the mesepisternal keel.

IV. *Wings* (Figs. 10, 11)

The Forewing

The forewing (Fig. 10) of *Idarnes* conforms to the typical chalcidoid pattern: veination is reduced to a single vein which has been subdivided into submarginal, marginal, postmarginal, and stigmal regions (Howard, 1887). The submarginal vein angles forward along its distal third and at the extreme end is notched; at the notch two campaniform sensilla are always present. The portion of the submarginal vein between the bend and the notch is often called the parastigma. The notch represents the beginning of the marginal vein, which continues to the fork where the stigmal and postmarginal veins originate. The stigmal vein may have a distal bulb which is called the stigma. The stigma invariably bears campaniform sensilla. The degree of stigmal development appears to be a species characteristic. The postmarginal vein is variable in length and usually bears a few small setae.

Close examination of the wing reveals distinct setal tracts which converge along the distal edge of the wing. Burks (1938), using representatives of 8 chalcid families



FIGS. 10-11. Right forewing (**10**) and hindwing (**11**) of *Idarnes* female.

(no torymids), attempted to correlate extensive setal tracts and obsolete venation with the hypothetical forewing venation of Ross. Unfortunately, the setal tracts of the *Idarnes* forewing do not reach the basal portion of the wing or connect with existing wing venation. Thus it is not possible to identify the setal tracts of *Idarnes* with the system of Burks.

Recently, Doutt and Viggiani (1968)[6]

[6] The systems of nomenclature employed by Burks and by Doutt and Viggiani are useful from a taxonomic standpoint, but imply a vestige of wing venation and hence homology. Since the tracts found in *Idarnes* are not from the same region of the wing and cannot be homologized with extant venation in other Hymenoptera, new terms seem necessary. Names used in the present work refer to areas with which the reader may be familiar and no presumptions of homology are intended.

have indicated that setal tracts provide taxonomic characters among species of trichogrammatids. Oldroyd and Ribbands (1936) found that these tracts of macrotrichae in *Trichogramma evanescens* were influenced by the size of the host from which the wasps emerged. Taxonomists of Torymidae have not used the tracts in classification, although they have been illustrated. Tracts have not been observed in other Sycophagini but in *Idarnes* have proven quite reliable in separating species and appear constant in their formation. Some variation of the type found by Oldroyd and Ribbands has been noted, but this has not proven a problem taxonomically.

The setal tracts of *Idarnes* all seem to merge with the conspicuous marginal fringe. The anterior-most tract may be called the *marginal tract;* it is always present in *Idarnes.* In some species it extends to the postmarginal vein *(I. micheneri),* while in others it terminates abruptly well in front of the postmarginal vein *(I. oscrocata).* Immediately behind the marginal tract is sometimes found a very short "R_1" which terminates behind the postmarginal vein *(I. simus).* A *submarginal tract* in some species originates along the apical wing margin and arches to the area of the stigma *(I. obtusifoliae).* Posterior to the submarginal tract and perpendicular to the distal edge of the wing is sometimes a variable *discal tract (I. barbigera).* This tract is absent from most species, and difficult to interpret when present owing to the random dispersal of microtrichae over the general wing surface. The microtrichae are widespread on the wing surface behind and beyond the stigma. *Idarnes jimenezi, I. obtusifoliae,* and *I. ashlocki* bear a tract composed of microtrichiae that are densely arranged along an imaginary longitudinal line which would conform to a median vein, hence the name *medial tract. I. jimenezi* also bears an *anal tract.*

Adstigmal setae, long, acuminate and located just mesad to the stigma, provide an additional forewing feature. Species tend to exhibit some variation in number, but distinct trends (clusters vs. 1 or 2 setae) are useful in determining species.

The Hindwing

The hindwing (Fig. 11) of *Idarnes* has proven to be of some taxonomic value. It is slender and elongate. The entire posterior margin bears a conspicuous fringe which is longer than the corresponding forewing fringe. Venation is much reduced from that of other Sycophagini, consisting of a short, stubby, submarginal vein. The region between the tip of the submarginal vein and hamuli may be setose and gives the appearance of a vestigial marginal vein. Other genera of Sycophagini have marginal veins. The entire wing surface bears microtrichiae.

V. *Female Legs* (Figs. 12-15)

The coxae conform in part to the typical torymid pattern: the hind coxa (Fig. 15) is larger than the fore coxa (Fig. 12), but the middle coxa (Fig. 14) is reduced, globular, and easily detached from the mesosoma. Sculpturing of coxae may be evident. The trochanters usually have sensilla near the apical margins. The mesothoracic femur is slender and atrophied. Additionally, it is basally constricted, giving the impression of a second trochanter being present. Femora of all legs may be mesally setose. The fore leg tibia posseses an apical bifurcate calcar (Fig. 13). Sensory spurs beneath the calcar form a comb which presumably facilitates antennal cleaning. Various authors (Grandi, Joseph) have used the number of apical tibial setae and spurs as a specific character. The present study has revealed the number to be variable, and not a good diagnostic character for *Idarnes* (cf. Wiebes,

1968). The middle tibia (Fig. 14) generally has a single large spur, while the rear tibia generally has 2 subequal spurs. The smaller spur may often be confused with part of the setal tract which runs along the length (mesad) of the hind tibia.

The ratio of basitarsal length to that of other tarsomeres proves to be reliable in separating species of *Idarnes*. The basitarsus of the fore leg possesses a mesal setal comb (the number of setae is again not constant) and invariably is shorter than the other basitarsi. The middle basitarsus is usually as long as the remaining tarsomeres, while the hind basitarsus is variable. All tarsomeres are clothed with variable numbers of setae which are not constant within species in number or arrangement.

VI. *Female Abdomen* (Figs. 6, 7, 23, 24)

The propodeum (Figs. 6, 7) is large with spiracles along the antero-lateral margin. Subparallel carinae and costulae are never present, but sculpturing may be developed. The gaster attaches to the propodeum via abdominal segment 2 (petiole), but the attachment is somewhat broad for clistogastrous Hymenoptera. The relatively broad attachment restricts the amount of flexibility possible for the gaster.

The gaster (Fig. 23) is comparatively simple. Its general shape ranges from ovoid with flat sterna to nearly spherical with the sterna convex. Tergal and sternal plates are conspicuous, though the extent of development of the sterna may be somewhat variable. The surface of each tergal sclerite may be lightly shagreened or smooth. These plates may be glabrous or setose along the posterior margin. The posterior margins of terga 2-6 may be either straight *(I. flavicollis)* or strongly sinuate *(I. obtusifoliae)*. The latter condition appears to be an adaptation for movement within the fig, since tergal margins which are sinuate permit more flexibility than straight margins. All sterna have posterior margins which are straight; sternal texture varies from coriaceous to smooth. Abdominal pleurites are absent.

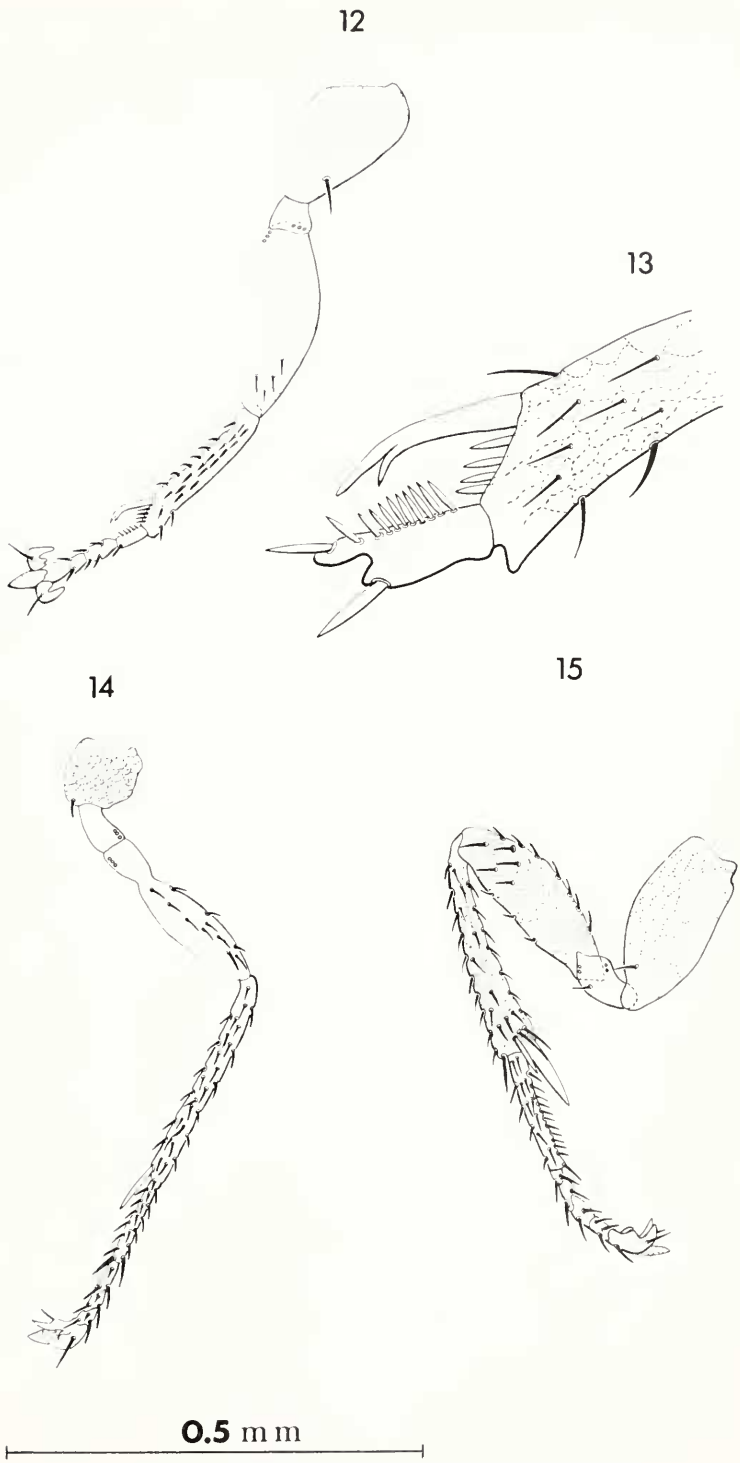
VII. *Female Genitalia* (Figs. 23, 24)

The most conspicuous feature of the female torymid gaster is the ovipositor. Morphologically, the external female genitalia represent lateral projections (gonostyli = sheath) and mesal extensions (gonapophysis = ovipositor) from gonocoxites of the eighth and ninth abdominal segments (seventh and eighth metasomal segments). *Idarnes* conforms to the rest of the Pterygota in that the gonostyli of gonocoxite 8 have been lost. The gonostyli of gonocoxite 9 are equal in length to the ovipositor, serving as a sheath.

In the ovipositor gonapophysis 8 is ventral, while 9 is dorsal. Smith (1969) has observed that gonapophysis 9 is inverted and interconnected with 8 along the long axis. The euventral surface of 9 provides a tongue (rachis) which fits within a trough (aulax) of gonapophysis 8. Smith calls the track locking gonopophysis 8 and 9 together an olistheter. His hypothesis is applicable to *Idarnes* since gonapophyses 8 and 9 are connected along their entire lengths.

In all species of *Idarnes,* the external female genitalia (Fig. 23) are several times longer than the gaster. The long ovipositor is an adaptation for penetrating the fig receptacle and depositing eggs inside the gall flowers. *Idarnes* is not adapted for entering the fig through the ostiole. During oviposition, only the gonapophyses penetrate the receptacle of the fig while the gonostyli diverge perpendicularly to the axis of penetration of the ovipositor. The mesal surface of each gonostylus appears transversely striated and is sparsely setose. The extreme tip of each gonapophysis is serrated to facilitate penetration of the receptacle.

As indicated by Smith (1969), insects retaining both gonapophysis 8 and 9 are



Figs. 12-15. **12,** Right fore leg of *Idarnes* female; **13,** enlarged calcar and strigil of *Idarnes* female fore leg; **14,** right middle leg of *Idarnes* female; **15,** left hind leg of *Idarnes* female.

limited in the distance 8 can be thrust in relation to 9 (for movement of the egg), and little vertical leverage can be applied against the ovipositional surface. In *Idarnes,* the problem is further complicated by the length of the gonapophysis. The former problem has been alleviated to an extent in most Hymenoptera by the development of an articulation of gonocoxite 8 with tergum 9.

The pygostyli (Fig. 24) are well developed and situated at the apex of the gaster. Three apical setae are present and are presumably sensory, indicating to the female precisely how deep the ovipositor has been thrust into the fig.

VIII. *Male Head* (Fig. 16)

All male *Idarnes* exhibit moderately sclerotized, depressed, subtrapezoidal, cranial capsules. The occipital foramen is located on the posterior surface of the head which is prognathous. The mandibles are located on the extreme anterior end of the head and are articulated in a horizontal plane. Dentition is variable among species, but hollow cones (of the type mentioned in females) are always present in the first and second teeth (cf. Figs. 74-82). Immediately posterior to the mandibles and along the lateral margins of the head are the compound eyes, identifiable only by red pigment spots. The ocular suture and ocelli are absent. Mesal to the compound eye, along the base of the mandible, two conspicuous, thick-walled toruli are present.

IX. *Male Antenna* (Fig. 5)

Antennae are 4- or 5-segmented. The basal segment is spoon-shaped and thick-walled, with setae over the dorsal surface and along the lateral margins. The distal surface is mesally concave, allowing the second segment (pedicel) to fit within. The second segment is elongate with thick walls, and often bears thickened setae along the apical end. The third segment is translucent (except *I. bucatoma*), lacks setae or thickened walls, and resembles a collar. Internally, a canal is visible which communicates between segments 2 and 4. In species with 5 segments, a small segment is present immediately distal to the third; species that have 4 antennal segments have this region completely fused with the club. The apical segment represents the fusion of 3 segments into a club. Setae are randomly dispersed over the club, with longitudinal carinae, thick setae, and sensilla on the terminus.

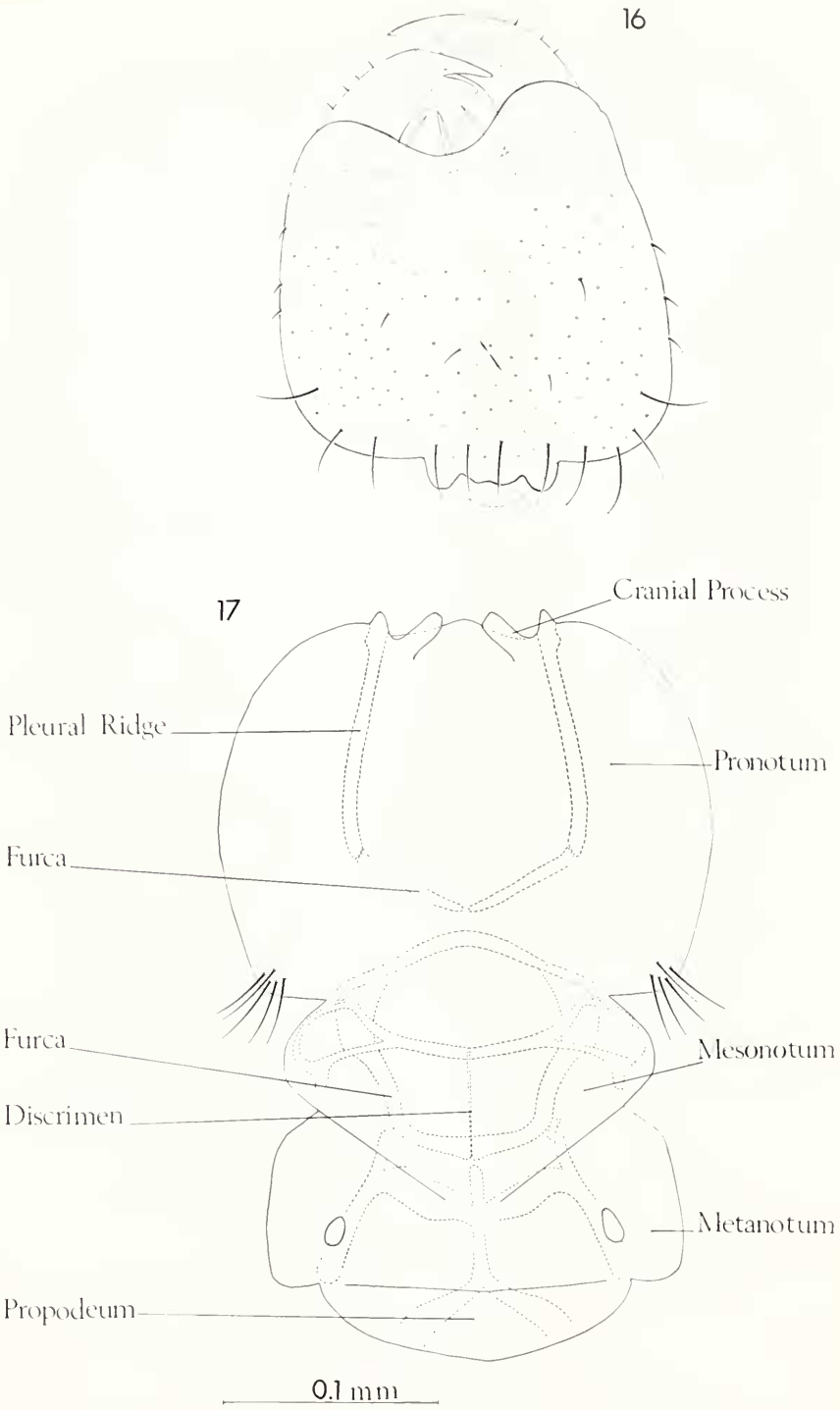
The labiomaxillary complex is completely absent, leading to the conclusion that males do not feed (a supposition supported by the comparatively short life of the male).

X. *Male Mesosoma* (Fig. 17)

The mesosoma is dorso-ventrally compressed, lightly sclerotized, and bears few external surface features. Internally, however, numerous heavily sclerotized ridges are conspicuous. Presumably these are for structural support. The pronotum represents the largest single sclerite of the mesosoma.[7] It is sometimes invested with setae, but more often is glabrous. The posterior margin of the pronotum is indicated by a distinct lateral constriction. Setae are often found in this region of the pronotum (cf. *I. micheneri*). A prescutum is not present in the male, hence the pronotum attaches directly to the mesoscutum.

Since males are apterous, the mesothorax is not fully developed as in the female. The lateral margins of the mesonotum project outward and these margins may or may not be setose. The remainder of the mesonotum is devoid of surface

[7] Reid (1941) has indicated that with the reduction of wings, the mesonotal region may become reduced; concomitant with this change, other regions of the thorax become enlarged. *Idarnes* conforms to Reid's observations in that the pronotum is much larger in the male than in the female.



Figs. 16-17. Head (**16**) and mesosoma (**17**) of *Idarnes* male, dorsal aspects.

features: notauli, scapulae, axillae, parascutella, and other features found on the female are absent from the male. Internally, however, an exceedingly complex network of apodemes may be noted. These provide points for muscle attachment which are presumably highly modified. In many species *(I. micheneri)* the mesothoracic discrimen is reduced. However, the internal apodemes (= furca) which it produces seem well developed. The furca of the male projects forward, joining other apodemes (see Fig. 17).

The posterior margin of the metanotum is marked by two very faint lines which project obliquely rearward but do not connect. The metanotum is slightly smaller than the mesonotum and there are numerous internal apodemes evident, but no external surface features are present. The metathoracic discrimen appears to be more fully developed than the corresponding mesothoracic structure. The furca is attached to parallel apodemes that connect to other apodemes of the mesothorax. The propodeal spiracles are located near the antero-dorsal edge of the propodeum.

Immediately beneath the pronotum lies the propleuron which is subdivided into a mesal proepisternum and a lateral proepimeron. Each region is about the same size, being separated by a large, conspicuous, internal pleural ridge. The ridge provides points of attachment for the sternal apophysis (furca) as well as for coxal pro- and remotors. This enlarged apodeme presumably provides strength for the legs, which are used to rip open the gall flowers in which the females develop. Anteriorly, the pleural ridge forms a very large bilobed cranial process. Unlike females, all males exhibit a ball-and-socket type cranial process into which the cranial lobe fits. The position of the paired cranial processes limits movement of the head to dorso-ventral flexion.

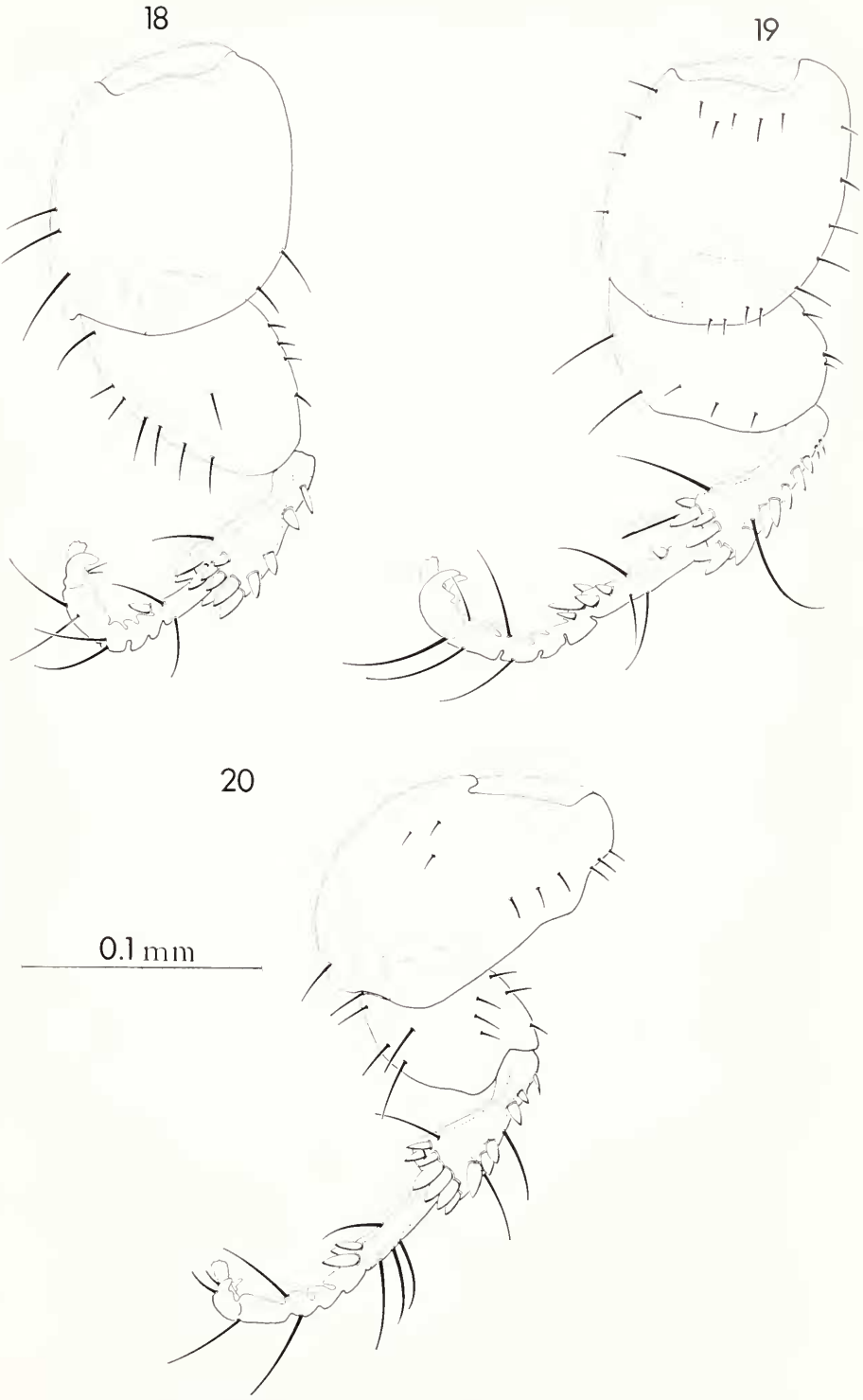
Immediately posterior to the mesally contiguous proepisterna is a small prosternum. It is variable in shape and bears apophyses which serve as endoskeletal support for the prothorax.

XI. *Male Legs* (Figs. 18-20)

The legs of the males are uniform in appearance. In fact, the legs of virtually all male fig-inhabiting wasps are strikingly similar, differing only in number of tarsal segments (cf. work of Joseph, Wiebes, Hill, and Grandi). All coxae are large, disc-like, and flattened dorso-ventrally, with setules and campaniform sensillae scattered over the surfaces. The trochanters are fused to the femora, and each appears as a sclerotized articulatory process on the basal portion of the femur. In some males a faint impression of the surface indicates the separation of the trochanter from the femur. All femora are smaller than the coxae and appear uniformly flat, disc-like, and lightly invested with setules and sensillae. Each femur is articulated in such a way that the dorsal surface may be rotated beneath and pressed against the ventral surface of the coxa. This feature permits the wasp to move among compact flowers within the fig receptacle.

Each tibia is heavily sclerotized, elongate, and invested with heavy spine-like setae along the outer and apical margins. These spines permit the wasp to wedge its body into narrow spaces. The fore tibia (Fig. 18) of the male lacks the strigil found in the female.

Five tarsomeres are found in male *Idarnes* (except in *I. bucatoma* which has 4). The basitarsus is more heavily sclerotized than the remaining segments and often bears apical spines similar to those found on the tibia. The remaining tarsomeres are lightly sclerotized and easily shed; many males collected from receptacles lack tarsomeres 2 to 5 on the fore legs. This probably results from tearing open gall flowers which contain females.



Figs. 18-20. Right fore leg (**18**), middle leg (**19**), and hind leg (**20**) of *Idarnes* male.

XII. *Male Gaster* (Fig. 21)

The gaster is globular and white. There are seven distinct terga and sterna with spiracles only on the seventh (eighth abdominal) tergum. Abdominal segments 8 and 9 are reduced and serve only as the origin of genital components. The posterior tergal margins of most species are sinuous, corresponding to the condition found in some females. Terga may be either glabrous or with distinct transverse rows of setae. The length and number of setae vary from species to species. Sterna are always glabrous.

XIII. *Male Genitalia* (Fig. 22)

The external genitalia of chalcidoids are relatively featureless when compared with other insects. The basic pattern of *Idarnes* is indicated below and except for size, little or no variation exists among species.

The basal ring which supports the external genitalic components is not evident in *Idarnes*. Instead, support seems drawn from aedaegal rods. The parameres are elongate, undivided lobes, united to the aedaegus basally. Volsellae lie between the parameres and the aedaegus.

The free portion of the aedaegus projects between the parameres and bears a pair of lateral rods. Beck (1933) considers these rods gonapophyses of the ninth abdominal sternum in bees; Michener (1944a) calls these "mesal basal processes of the gonocoxopodites"; Snodgrass (1951) calls them "lateral sclerotizations of the aedaegus supporting the aedaegal apodemes."

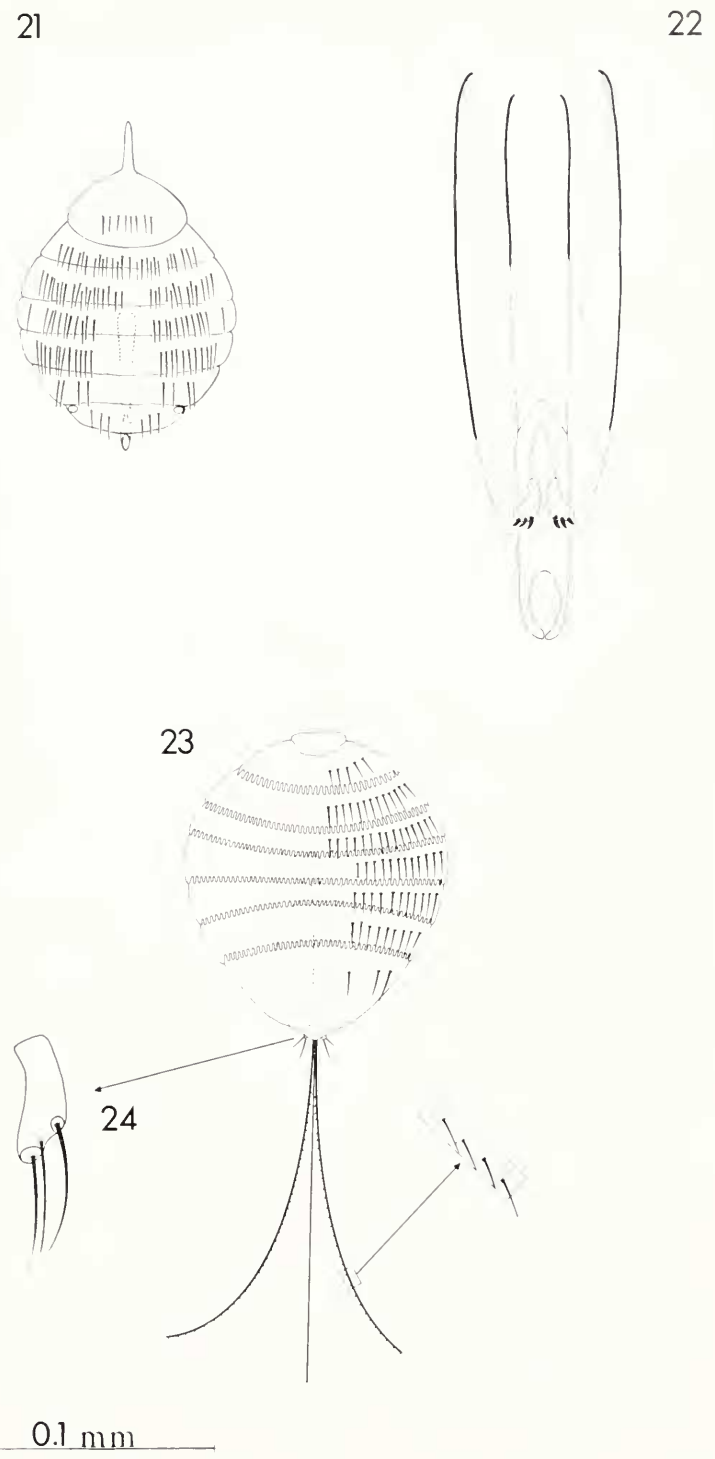
The volsellae appear unique to the Hymenoptera. Each one consists of an elongate, ventral plate which lies adjacent to the paramere. At the distal end are the digitus and cuspis. These are strongly musculated and form pincers. Snodgrass (1941, 1951) and Michener (1944a) have indicated these are used by most Hymenoptera to grasp and spread female genital membranes during copulation. They presumably function in a similar manner for *Idarnes*.

SYSTEMATICS, MORPHOLOGY, AND DISTRIBUTION OF *FICUS*

The genus *Ficus* (Moraecae) includes over 900 described species placed in four subgenera: *Urostigma* (Banyans), *Pharmacosycea, Sycomorus,* and *Ficus* (Croizat, 1952; Corner, 1958, 1965). Of these, only the first two are native in the New World. All members of the genus bear conspicuous hollow syconia (when mature, these are the fig "fruits") which enclose the flowers which line the syconial cavities. Three types of flowers exist: male flowers that contain anthers, female flowers, and gall flowers. Condit and Flanders (1945) indicated that the term gall flower is a misnomer since this floral type represents short-styled female flowers. The term will be retained, however, because it is convenient and well established. The arrangement and location of staminate or pistillate flowers within the syconium provide the foundation of fig classification. In monoecious species, male, female, and gall flowers are randomly interspersed within the same syconium; dioecious species bear male and female flowers on separate trees with male flowers usually arranged in rows around the ostiole, which is the opening into the syconial cavity.

Most species of figs yield 3 or 4 crops per year. A tree will usually have all fruits in the same stage of development, but within a region, trees of the same species may be in different floral stages. This adaptive feature insures pollination by agaonids.

Ficus is absolutely dependent upon insects for pollination; all pollinators belong to the family Agaonidae. Recent studies (Ramírez, 1970a, 1970b; Hill, 1967a, 1967b, 1969; Joseph, 1966; Wiebes, 1964, 1966a) have indicated a high degree of host spe-



Figs. 21-24. **21,** Metasoma of *Idarnes* male, dorsal aspect; **22,** genitalia of *Idarnes* male, ventral aspect; **23,** metasoma of *Idarnes* female, dorsal aspect; **24,** pygostyle of *Idarnes* female, ventral aspect.

cificity between pollinating wasp and tree.

The life history and pollination ecology of numerous agaonids have been established (Baker, 1913; Galil and Eisikowitch, 1968; Ramírez, 1969; Williams, 1928; Eisen, 1896; Carmin and Scheinkin, 1931; Cunningham, 1889). Within a mature syconium the insects develop inside the gall flowers. The wingless males emerge first and move around within the syconium in search of females of the same species. The male locates a gall flower containing a female, gnaws a hole in the gall, and mates with the immobile female. Emergence from the syconium is achieved by the males tunneling through the fig wall or ostiolar scales. Several males may work in the tunnel simultaneously, and if the tunnel is not completed, all the inhabitants of a syconium will die.

The winged females, before leaving their natal fig, gather pollen from the male flowers which are ripe at this time. Some female pollinators collect pollen in sternal or coxal corbiculae. Upon emergence from the fig, the females fly to a tree of the same species in the proper floral phase and enter the figs via the ostiole.

Once inside the fig, the agaonid wanders about, pollinating long-styled female flowers; subsequently, she oviposits in the short-styled gall flowers. Female pollinators always die inside the receptacle. The young of the next generation mature during the male phase of the same fig.

THE PARASITES IN FLORAL ECOLOGY

Many non-pollinating hymenopterous inhabitants of figs, members of the families Torymidae and Eurytomidae, have been described. The relationship between *Idarnes* and the pollinating agaonids has not been completely established. Kattamathiathu (= Joseph) (1955) has indicated that *Philotrypesis caricae,* another torymid fig inhabitant, develops "cleptoparasitically" at the expense of *Blastophaga psenes,* pollinator of the edible fig, *Ficus (Ficus) caricae. P. caricae* lacks the so-called "poison glands" which Grandi (1930, 1961) indicated are necessary for the preparation of gall flower endosperm. *B. psenes* presumably induces gall formation (hence "gall flowers") when its eggs are deposited inside a short-styled flower. Later, the parasite lays its eggs in the same flower and both larvae begin to develop. Both *Blastophaga* and *Philotrypesis* develop through the second instar at which time the parasite kills the pollinator but does not feed upon it.

Concerning the development of *Idarnes,* the following observations can be made:

Examination of preserved syconia of *Urostigma* figs reveals that the parasites also develop within short-styled flowers. Each flower appears to contain only one pollinator or parasite. Wiebes (1968) has shown that in rare instances two wasps may develop within the same flower. A similar observation has not been made for *Idarnes.* It has not been established if the male *Idarnes* mates with the female before or after her emergence from the gall flower or if the male parasites aid the male agaonids in digging an exit tunnel through the wall of the receptacle. One interesting feature of the material examined appears to be the constancy of the tunnel site. Each species of fig appears to have a unique site for the emergence hole.

Joseph (1956) has indicated that female torymid parasites will live up to 35 days in the laboratory. *Idarnes* females have been kept alive at high humidity (+70%) for 9 days without feeding.

Observations of *I. oscrocata* have revealed that newly emerged females do not immediately oviposit within receptacles of proper age. Instead, they congregate on the undersides of leaves and on branches of the host tree. Branches and leaves hav-

ing quiescent *Idarnes* also bear fruits into which pollinating agaonids are burrowing. If the hypothesis of Grandi regarding atrophied poison glands is correct, the torymids would delay oviposition until after pollination and egg laying by the agaonids.

Females of *Idarnes* do not enter the fig through the ostiole. Instead, they use their long ovipositors to penetrate the receptacle of the fig. Initially the female moves rapidly over the receptacle, but eventually she slows down. Movement over the syconium continues for a few minutes to half an hour. Several females may be noted on one receptacle. Upon selection of a suitable place for oviposition, the wasp moves forward slightly, raises the gaster and elevates the body by extending the legs. After the tip of the ovipositor has been inserted into the receptacle surface, the wasp moves the body on an anterior-posterior axis, forcing the ovipositor deeper into the receptacle. The wasp moves rearward as the ovipositor penetrates more deeply. Occasionally, females have been observed to discontinue drilling and search for another oviposition site on the same fig. As the ovipositor penetrates the receptacle, the gonostyli project rearward or postero-laterally. After laying is completed, the female pulls herself forward, extracting the ovipositor.

Developmental time of the parasite varies with the species but is approximately the same as that of the agaonid pollinators. Ramírez (1970b) has observed that for most New World species of *Ficus*, almost every syconium on a tree is pollinated during a single day. Oviposition by *Idarnes* is not as restricted since many parasites may be collected from trees several days after oviposition by the pollinators.

HOST SPECIFICITY AND *IDARNES*

The following data indicate that *Idarnes* develops exclusively within *Urostigma* figs: (1) In 17 collections of figs of the subgenus *Pharmacosycea* made throughout México during two successive years, only parasites of the genus *Critogaster* emerged from receptacles or were found ovipositing into these figs. (2) In 56 collections of *Urostigma* figs made in México and Central America, 3 genera of parasites were collected: *Heterandrium*, *Physothorax*, and *Idarnes*. *Idarnes* was always the most abundant. (3) At two localities (Izucar de Matamoros, Puebla, México and 12 miles west of Veracruz, México) species of *Urostigma* and *Pharmacosycea* were growing sympatrically and wasps were emerging from each fig species. *Idarnes* aggregated on *Urostigma* and *Critogaster* aggregated on *Pharmacosycea*, even though the trees were separated by only 15 to 20 meters. In personal communications, Ramírez has indicated his finding of *Idarnes* only in figs of the subgenus *Urostigma*, not only in México and Central America but also in Venezuela.

Host specificity is also indicated by a study of ovipositor lengths. Ovipositors must be long enough to penetrate the syconial walls. Informal study, not supported by data on wall thicknesses, shows that species of *Idarnes* with long ovipositors inhabit figs with thick walls and those with short ovipositors inhabit small figs with thin walls. Obviously, the *Idarnes* with short ovipositor could not successfully infest figs with thick walls.

Recent authors (cf. Wiebes, Ramírez, Hill, and Joseph, loc. cit.) have indicated a high level of host specificity between pollinator and species of *Ficus*. Although the proof is not conclusive, a similar tendency exists between *Idarnes* and *Ficus*. Ten different species of *Idarnes* have been collected from 10 different species of fig. Moreover, where collections were made in different areas from the same species of fig, the wasps in all instances were pre-

sumably conspecific. At least they were morphologically more similar to one another than to different species of *Idarnes* collected on different fig species in the same or adjacent areas.

It is entirely unknown whether host specificity is based on host fig alone or also on the pollinator species. Table 1 lists the known *Urostigma* pollinators and their parasites.

REDEFINITION OF *IDARNES*

Idarnes Walker, 1843

Idarnes Walker, 1843, Ann. Mag. Nat. Hist. 12:47, ♀.

Type species: *Idarnes carme* Walker (monotypic).

Tetragonaspis Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35.205, ♀.

Type species: *Tetragonaspis flavicollis* Mayr.

Ganosoma Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35.204, ♂.

Type species: *Ganosoma robustum* Mayr.

Idarnes Ashmead, 1904, Mem. Carnegie Mus. 1:238-239; 395.

Female—Head, mesosoma metallic green; gaster tan with metallic luster; compound eye asetose, red; scape, pedicel amber, remaining segments darker. Head sculptured; antenna inserted below transverse middle line of compound eyes; scrobe cavity extending to anterior median ocellus or vertex; inter-antennal ridge present, but variable. Antenna 12-segmented with 1 annulus or 13-segmented with 2 annuli; flagellomeres carinate and setose; club variable, terminal protuberance present. Mandible bi- or tridentate; stipes with basal acuminate seta; maxillary palpus 2-segmented, segment 1 with disc-shaped sensillum along distal margin, terminal segment with proximal acuminate seta and distal margin excindate; labial palp 1-segmented, ligula with 2 to 5 sensory pegs; galea with numerous acuminate setae.

Pronotum sculptured, collar-like; mesoscutum sculptured, separated from scapula by well developed notaulix; mesoscutellum quadrate; forewing with parastigmal notch sensillate; stigma sensillate; adstigmal setae present; setal tracts conspicuous; hindwing with submarginal vein only. Fore leg with bifurcate calcar; basitarsus with conspicuous strigil; middle leg with coxa small, globular; middle femur slender, with 1 or 2 subapical spurs; hind coxa 3 times as large as fore coxa; hind femur setose, sculptured; hind tibia with 1 or 2 subapical spurs. Proepisterna sculptured,

TABLE 1. Neotropical *Urostigma* figs, pollinators *(Blastophaga)*, and their known *Idarnes* parasites.

Tree	Pollinator	Parasite	Collections	Known distribution
Ficus aurea Nuttall	*B. mexicana* Grandi	*I. carme* Walker	2	West Indies, Florida
F. cervantesiana Standley		*I. bucatoma* sp. nov.	1	Costa Rica
F. colubrinae Standley	*B. orozcoi* Ramírez	*I. galbina* sp. nov.	1	Costa Rica
F. goldmanii Standley		*I. oserocata* sp. nov.	2	Mexico, Costa Rica
F. hemsleyana Standley	*B. tonduzi* Grandi	*I. barbigera* sp. nov.	2	Mexico, Costa Rica
F. isophelebia Standley	*B. urbanae* Ramírez	*I. micheneri* sp. nov.	1	Costa Rica
F. jimenezii Standley	*B. jimenezii* Grandi	*I. jimenezi* sp. nov.	1	Costa Rica
F. lapithifolia Liebmann	*B. aguilari* Grandi	*I. simus* sp. nov.	1	Costa Rica
F. obtusifolia H. B. K.	*B. hoffmeyeri* Grandi	*I. obtusifoliae* sp. nov.	3	Mexico, Costa Rica
F. oerstediana Miguel	*B. standleyi* Ramírez	*I. camini* sp. nov.	2	Mexico, Costa Rica
F. tuerckheimii Standley	*B. mariae* Ramírez *B. carlosi* Ramírez	*I. ashlocki* sp. nov.	4	Mexico, Costa Rica
F. velutina Willd.	*B. torresi* Grandi	*I. flavicollis* Mayr	1	Brazil, Costa Rica

prepectus not completely separated from mesepisternum; discrimen well developed; anapleurite present.

Male—Head, mesosoma tan, depressed; gaster white, globular; compound eye reduced to pigmented spot or absent; ocelli absent; antenna 4- or 5-segmented, basal segment with thick walls, segment 3 translucent; mandible bi- or tridentate, often scythe-like; labiomaxillary complex absent.

Pronotum depressed, larger than remaining thoracic components; wings absent; coxae, femora disc-shaped, dorsoventrally flattened; tibiae with large conspicuous spines; basitarsi with apical spurs.

Propodeum reduced, demarcated from metanotum by faint, transverse line, spiracles along antero-lateral margin; gaster with tergites setose; posterior tergal margin often sinuate.

KEY TO SOME SPECIES OF *IDARNES*

1. Head and mesosoma bronze; gaster tan with metallic luster; antenna 12- or 13-segmented; 3 ocelli and compound eyes present; wings present; ovipositor longer than remainder of body ..... Females 2
– Head and mesosoma tan; gaster white; antenna with 4 or 5 segments; ocelli, compound eyes, and wings absent ..... Males 13
2. Mandible tridentate; clypeal margin bilobed; antenna 13-segmented with 2 ring segments; mesoscutellum lightly shagreened or smooth; posterior tergal margin straight 3
– Mandible bidentate (except *I. obtusifoliae*); clypeal margin variable; antenna 12-segmented with single ring segment (except *I. simus*); mesoscutellar sculpture variable; posterior tergal margin strongly sinuate 6
3. Head prognathous; antennal scape and pedicel strongly setose (Fig. 26); pedicel twice as long as wide; flagellar setae not verticillate; club compact; pronotum as large as mesoscutum and scapulae combined; adstigmal setae of forewing forming a dense cluster (Fig. 54) ..... *I. bucatoma*
– Head hypognathous; antennal scape and pedicel bearing few setae; pedicel not elongate; flagellomeres with distinct whorls of setae basally; club not compact; pronotum smaller than mesoscutum and scapulae combined; forewing with fewer adstigmal setae 4
4. Vertex of head flat; frons weakly rugose ..... *I. camini*
– Vertex of head convex; frons smooth 5
5. Toruli just below middle line of compound eyes; scrobe shallow, smooth; clypeus bilobed; ovipositor 4.5 times gaster length; gonostyli bearing only a few small setae ..... *I. flavicollis*
– Toruli at lower margin of compound eyes; scrobe cavity deep, rugose; clypeus trilobed; ovipositor 3.5 times gaster length; gonostyli bearing large conspicuous setae along mesal surface ..... *I. micheneri*
6. Antennal flagellomeres, 2 times as long as wide (Fig. 34); ovipositor 5 times gaster length ..... *I. simus*
– Flagellomeres less than 2 times as long as wide; ovipositor less than 5 times gaster length 7
7. Antenna inserted at or just below middle line of compound eyes; mesoscutellum lacunose or smooth; stigma not tumid 8
– Antenna inserted at level of ventral margin of compound eyes; mesoscutellum smooth; stigma tumid 9
8. Interantennal ridge acute; marginal tract not extending to postmarginal vein (Fig. 56); prepectus laterally favose, mesally rugose; ovipositor 4 times gaster length; gonostylar setae minute ..... *I. barbigera*
– Interantennal ridge flat; marginal tract reaching postmarginal vein (Fig. 50); prepectus uniformly rugose; ovipositor 2.5 times gaster length; gonostylar setae conspicuous ..... *I. galbina*
9. Anal tract absent; ovipositor at least 3.0 times gaster length 10
– Anal tract present (Fig. 59); ovipositor 2.5 times gaster length .... *I. jimenezi*
10. Scape extending to vertex; frons smooth; prepectus favose, pattern fading mesally, mesepisternum laterally rugose, shagreened at discrimen; ovipositor 6 times gaster length;

gonostylar setae minute ..... *I. oscrocata*
– Scape not reaching vertex; frons not smooth (except *I. carme*); ovipositor several times more or less than 6 times gaster length 11
11. Vertex sinuous as seen from front; frons, prepectus favose; mesepisternum laterally favose, smooth at discrimen; ovipositor 8 times gaster length ..... *I. obtusifoliae*
– Vertex flat; frons not lacunose; prepectus rugose; mesepisternum laterally rugose; ovipositor considerably less than 8 times gaster length 12
12. Frons favose; terga smooth; ovipositor 4 times gaster length ..... *I. ashlocki*
– Frons smooth; gastral terga shagreened; ovipositor 3 times gaster length ..... *I. carme*
13. Antenna 4-segmented (Fig. 43), segment 3 not translucent; legs with 4 tarsomeres (Figs. 116-118). .. *I. bucatoma*
– Antenna 4- or 5-segmented, segment 3 translucent; legs with 5 tarsomeres 14
14. Antenna 4-segmented with no constriction at base of club 15
– Antenna 5-segmented or 4-segmented with a constriction at base of club 18
15. Mandible tridentate, not scythe-like; posterior tergal margin sinuate 16
– Mandible bidentate, occasionally scythe-like; posterior tergal margin straight or sinuate 17
16. Antenna 4-segmented (Fig. 46), flagellomeres moderately setose; middle and hind tibiae with long apical spurs (Figs. 105, 106) ..... *I. micheneri*
– Antenna 4-segmented, flagellomeres sparsely setose (Fig. 37); tibiae without long apical spurs (Figs. 86-88) ..... *I. galbina*
17. Hind tibia with large apical spur; middle and hind basitarsi spinose, elongate (Figs. 99, 100); gastral sterna with minute setae ..... *I. camini*
– Tibiae with apical spurs of intermediate length; basitarsi with few apical spines (Figs. 110-112) ..... *I. jimenezi*
18. Tibiae without large spurs 19
– Middle and/or hind tibiae with long apical spurs 20
19. Hind basitarsus lacking apical spines, nearly as long as tibia (Fig. 115); clypeal margin with 2 small mesal spines ..... *I. oscrocata*
– Hind basitarsus with apical spines, less than half as long as tibia (Fig. 91); clypeal margin lacking mesal spines ..... *I. simus*
20. Mandible tridentate (Fig. 75) ..... *I. flavicollis*
– Mandible bidentate 21
21. Mandible scythe-like; posterior tergal margin straight 22
– Mandible not scythe-like; posterior tergal margin sinuate 23
22. Head with small setae uniformly distributed on dorsal surface; clypeal margin straight; middle and hind tibiae with apical spurs (Figs. 108, 109) ..... *I. barbigera*
– Dorsal surface of head sparsely setose; clypeal margin concave; tibiae lacking long apical spurs (Figs. 95-97) ..... *I. carme*
23. Middle tibia with long apical spur (Fig. 102) ..... *I. obtusifoliae*
– Middle tibia without long apical spur (Fig. 84) ..... *I. ashlocki*

SYSTEMATIC TREATMENT

All of the named species that fall in *Idarnes* as here restricted are listed in this section. Locations of type material and voucher specimens for newly described species or species treated in detail appear in Table 2. Etymological origins of new names are given in Table 3.

Characters are sequentially numbered in each description for convenient comparison among descriptions. For example, mandibular dentition may be ascertained for females of all species by looking for number 21 in each description.

Idarnes ashlocki, new species

Female—Body length 1.5 mm, ovipositor 4.0 mm long. (1, 2) Head, mesosoma metallic mossy green; (3) gaster bronze with metallic luster; (4) scape, pedicel smoky brown, remaining segments ebony; (5) legs uniformly tawny; (6) prosternum, mesosternum metallic green.

(7) Head hypognathous, in frontal aspect wider than long; compound eye weakly protuberant; (8) entire head with

Table 2. Disposition of types and voucher specimens of *Idarnes*.[a]

	K.U.	U.S.N.M.N.H.	Pret.	Lenin.	B.M.	Leiden	Canberra	Ramírez
I. ashlocki	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. barbigera	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. bucatoma	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. camini	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. carme	1 ♀ 1 ♂	♀ Neo 1 ♂	1 ♀	1 ♀	1 ♀	1 ♀	1 ♀	1 ♀
I. flavicollis	1 ♀ 1 ♂	1 ♀	1 ♀	1 ♀	1 ♀	1 ♀	1 ♀	1 ♀
I. galbina	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. jimenezi	♀ H ♂ A	1 ♀ P 1 ♂	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. micheneri	♀ H ♂ A	1 ♀ P 1 ♂	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. obtusifoliae	♀ H ♂ A	1 ♀ P 1 ♂	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. oscrocata	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P
I. simus	♀ H ♂ A	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P	1 ♀ P

[a] Abbreviations used. Names in parentheses refer to individual to whom material was sent.
K.U. = Snow Entomological Museum, University of Kansas, Lawrence, Kansas (G. W. Byers).
U.S.N.M.N.H. = U.S. National Museum of Natural History, Washington, D.C. (B. D. Burks).
Pret. = Plant Protection Research Institute, Pretoria, Republic of South Africa (D. P. Annecke).
Lenin. = Zoological Institute, Academy of Science, Leningrad, U.S.S.R. (V. Trjapitzin).
B. M. = British Museum (Natural History), England (R. D. Eady).
Leiden = Rijksuniversiteit, Leiden, Netherlands (J. T. Wiebes).
Canberra = C.S.I.R.O., Canberra, Australia (E. Riek).
Ramírez = W. Ramírez.
H = Holotype; P = Paratype; A = Allotype; Neo = Neotype.

Table 3. Etymological origin of new *Idarnes* species names.

Epithet	Origin
I. ashlocki	Patronym of P. D. Ashlock, Hemipterist
I. barbigera	barbigera = bearded
I. bucatoma	bu = large; catoma = shoulders
I. camini	Patronym of J. H. Camin, Acarologist
I. galbina	galbina = jaundiced
I. jimenezi	*Ficus jimenezii*
I. micheneri	Patronym of C. D. Michener, Hymenopterist
I. obtusifoliae	*Ficus obtusifolia*
I. oscrocata	os = mouth; crocatus = saffron yellow
I. simus	simus = flat nosed

bold, uniform favose sculpture; setae sparse; (9) margin of vertex flat; (10) antenna inserted at ventral margin of compound eye; (11) toruli separated by twice diameter of torulus; (12) scrobe with 2 favose, shallow channels converging at anterior ocellus; (13) interantennal ridge not strongly convex. (14) Antenna 12-segmented (Fig. 28); (15) scape shagreened, setose, extending to median ocellus; (16) pedicel shagreened, setose; (17) flagellomeres as wide as long, verticillate; setae inflexible; setae and carinae equal in number; (18) club weak; terminal protuberance inconspicuous. (19) Frons favose, asetose; (20) clypeal margin weakly bilobed; (21) mandible (Fig. 63) tridentate, tooth margin sharply incised. (22) Maxillary palpus 2-segmented, palpifer not evident; (23) palpiger not evident; (24) ligula with 2 sensory pegs; (25) paraglossa enveloping 3/4 of ligular margin; (26) galea strongly setose.

(27) Pronotum favose along posterodorsal margin, remainder shagreened; (28, 29, 30, 31) mesoscutum, scapula, parascutellum and axilla favose; (32) mesoscutellum lacunose; (33) meson of metanotum favose, lateron smooth. (34) Forewing (Fig. 51) with submarginal vein 3.5 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma weakly tumid; (36) 2 adstigmal setae; (37) marginal tract ending well before postmarginal vein; R_1 tract ending before terminus of marginal tract; submarginal tract reaching stigma; medial tract present; discal, anal tracts absent. (38) Fore and hind coxae lightly sculptured, middle coxa smooth; (39) femora sculptured; (40) middle and hind tibiae each with single large apical spur; (41) fore basitarsus as long as tarsomere 2; middle basitarsus as long as tarsomeres 2-5; hind basitarsus as long as tarsomeres 2-4. (42) Proepisternum bronze, lightly sculptured, smaller than fore coxa, bearing single cranial process; (43) prosternum triangular, lightly shagreened; discrimen short; (44) prepectus rugose; (45) mesepisternum laterally rugose, pattern becoming shagreened at discrimen; (46) mesepimeron uniformly rugose; (47) anapleurite lightly shagreened.

(48) Propodeum 3.5 times as wide as long; meson favose, with pattern laterally evanescent; (49) gaster larger than head and mesosoma; (51) sterna glabrous; (52) ovipositor and gonostylus 4 times gastral length; (53) gonostylar setae short.

Male—Body length 2.0 mm. (54, 55) Head, mesosoma tan; mandible dark red; (56) gaster milky white; (57) third antennal segment translucent, remaining segments tan; (58) leg segments concolorous with mesosoma.

(59) Head with lateral margin bearing short setae; (60) mandible (Fig. 71) bidentate, scythe-like; tooth margin not sharply incised; (61) antenna (Fig. 39) 4-segmented, basal portion of segment 4 constricted, nearly forming a distinct segment; (62) all legs with 5 tarsomeres (Figs. 83-85); hind tibia with long apical spur, basitarsi elongate. (63) Gastral terga smooth, with long setae; posterior tergal margins sinuate; (64) sterna smooth, asetose.

Material—Described from 16 females and 3 males collected at San Rafael, Heredia, Costa Rica on 23 May 1964 by William Ramírez; 14 females and 2 males collected 7 miles northeast of Coscomatepec, Veracruz, México on 8 August 1969 by the author and Ramírez; 12 females and 1 male collected 10 August 1969 at Córdoba, Veracruz, México by Ramírez; and 16 females and 4 males collected by the author at Campeche, Campeche, México on 7 July 1970. In each instance the host fig was *Ficus tuerckheimii* Standley.

Ficus tuerckheimii is distributed throughout Central America and México. Standley (1917) indicates it is closely re-

lated to *F. jimenezii,* but differs in leaf shape and venation.

Holotype—A dissected female mounted in Hoyer's medium on 2 slides, each with 3 coverslips. Both labels are inscribed: "*Idarnes ashlocki.* San Rafael, Heredia, Costa Rica. 23 May 1964, leg. W. Ramírez, ex. *F. tuerckheimii.* HOLOTYPE." *Allotype*—One dissected male mounted in Hoyer's medium on 1 slide under 3 coverslips. The label bears the same data as indicated above. *Paratypes*—Nine females mounted in the manner indicated for the holotype above with a simliar label inscription.

Variation—Idarnes ashlocki females are quite constant in appearance. Some variation in the vertex shape (9), length of setal tracts in the wings (37), number of adstigmal setae (36), and shape of the prosternum (27) have been noted. Males from the northern limit of the species may have scythe-like mandibles (60).

Comparative Comments—I. ashlocki seems most nearly related to *I. obtusifoliae,* but may be distinguished from this and other species of *Idarnes* on the basis of the following characters: females with favose sculpture on head (8) and mesosoma (28, 29, 30, 31), antenna inserted at ventral margin of compound eye (10), wings with short marginal and R_1 vein tracts (37), and mesepimeron rugose (46).

Idarnes barbigera, new species

Female—Body length 1.8 mm, ovipositor 4.0 mm long. (1, 2) Head and mesosoma brown with tawny luster; margin of oral fossa light; (3) gaster chestnut brown; (4) scape tan, remaining segments rust red; (5) fore coxa basally tan, remaining segments dull translucent white; (6) prosternum translucent; mesosternum concolorous with gastral sterna.

(7) Head hypognathous, in frontal aspect wider than long; compound eye protuberant; (8) gena setose, smooth; face rugose with pattern progressively bolder dorsally, vertex favose; (9) vertex sinuate; (10) antenna inserted just below middle line of compound eye; antennifer large; (11) toruli separated by single torulus diameter; (12) scrobe deep, lacunose, extending to anterior ocellus; (13) interantennal ridge acute. (14) Antenna (Fig. 25) 12-segmented; (15) scape with minute setae along dorsal and mesal surface extending to vertex; (16) pedicel elongate, smooth, with few setae; (17) flagellomeres slightly longer than wide, verticillate, setae inflexible; setae more numerous than carinae; (18) club terminal protuberance weakly formed. (19) Frons glabrous with marginal setae; (20) clypeal margin with single lobe; (21) mandible bidentate (Fig. 61), tooth margin sharply incised. (22) Maxillary palpus 2-segmented; palpifer not evident; (23) palpiger not evident; (24) ligula bearing 4 sensory pegs; (25) paraglossa enveloping 5/6 of ligular margin; (26) galea with moderate number of acuminate setae.

(27) Pronotum postero-dorsally favose, remainder smooth; (28, 29, 30, 31) mesoscutum, scapula, axilla, parascutellum favose; (32) mesoscutellum smooth; (33) meson of metanotum lacunose, lateron smooth. (34) Forewing (Fig. 56) with submarginal vein 3 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma weakly tumid, sensillae small; (36) 2 short adstigmal setae; (37) marginal tract ending well before postmarginal vein; R_1 tract absent; submarginal tract reaching stigma; discal tract present; median and anal tracts absent. (38) Hind coxa sculptured, remaining coxae smooth; (39) middle femur with setal tract; (40) middle tibia with single tibial spur; hind tibia with 2 setal tracts, 2 subequal apical spurs; (41) fore basitarsus as long as tarsomeres 2-4; middle basitarsus as long as remaining tarsomeres; hind basitarsus as long as tarsomeres 2-4. (42) Proepisternum smaller

than fore coxa, shagreened, with single large cranial process; (43) prosternum semicircular, glabrous; discrimen extending half length of structure; (44) prepectus laterally favose, pattern rugose mesally; (45) mesepisternum rugose laterally, pattern fading mesally, glabrous at discrimen; (46) mesepimeron lacunose; (47) anapleurite lacunose.

(48) Propodeum 4 times as wide as long, smooth, median longitudinal carina absent; (49) gaster ovoid, slightly larger than mesosoma; (50) tergum shagreened, pattern lightly incised; posterior tergal margins sinuate; (51) strena coriaceous, weakly setose; (52) ovipositor and gonostylus 4 times gaster length; (53) gonostylar setae along mesal surfaces minute.

Male—Body length 1.2 mm. (54, 55) Head, mesosoma tan; (56) gaster milky white; (57) antennal scape, base of segment 2 amber, club pale; (58) coxae, femora concolorous with mesosoma, tibiae marginally red.

(59) Head with small setae uniformly distributed over dorsal surface; clypeal margin straight, bearing 2 moderately sized acuminate setae; (60) mandible (Fig. 80) scythe-like, bidentate; (61) antenna (Fig. 44) 4-segmented; club spindle-shaped; (62) legs with 5-segmented tarsi; tibio-tarsal complex (Figs. 107-109) with middle and hind basitarsi elongate; (63) terga asetose, posterior tergal margins straight; (64) sterna smooth.

Material—Described from 16 females and 4 males collected at Sarchi Garcia, Alajuela, Costa Rica on 17 June 1964 from *Ficus hemsleyana* by William Ramírez, and 241 females collected by the author at 4 miles south of Rio Hondo, Oaxaca, México on 6 July 1970 from *F. hemsleyana*.

Condit (1969) indicates *F. hemsleyana* is synonymous with *F. citrifolia*. Although Standley (1917) did not have material available from México, the voucher specimen collected in 1970 agrees with Standley's description. DeWolf (1960) lists 29 synonomous names for *F. citrifolia*, among which is *F. hemsleyana*. He cites the distribution as Florida to Paraguay. Among the major synonyms are *F. laevigata* Vahl, *F. judunculata* Dryand, *F. pyrifolia* Desfontaines and *F. brevifolia* Nuttall. Collections of *Idarnes* and *Blastophaga* from these figs should be compared with the type description to examine host specificity and the validity of DeWolf's synonomy.

Holotype—A dissected female mounted in Hoyer's medium on 2 slides each bearing 3 coverslips. Both labels are inscribed: "*Idarnes barbigera*. Sarchi Garcia, Costa Rica. 17 June 1964, leg. W. Ramírez, ex. *Ficus hemsleyana*. HOLOTYPE." *Allotype*—A single dissected male mounted in Hoyer's medium on 1 slide with the parts under 3 coverslips. The inscription on the label is the same as above. *Paratypes*—Eight females are balsam-mounted in the manner indicated above, with the same label inscription, and the parts of each insect are on 1 slide.

Variation—All females from México have strongly sculptured fore coxae (38), unlike those from Costa Rica. Individuals collected in México are virtually identical in other features to those collected in Costa Rica.

Comparative Comments—Females may be recognized by the following key characters: gena smooth and setose (9), frons glabrous with marginal setae (19), smooth mesoscutellum (32), cranial process of proepisternum very large (42), and mesepimeron lacunose (46). Males are recognized by the short setae on the dorsal surface of the head (59), scythe-like, bidentate mandible (60), 4-segmented antenna (61), and asetose terga (63).

Idarnes brevicolis (Mayr)

Tetragonaspis brevicolis Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:209, ♀.

Mayr described *I. brevicolis* from the female only. I have not examined the type

material but it was collected in Brazil. It is considered a species of *Idarnes* as here restricted.

Idarnes bucatoma, new species

Female—Body length 3.4 mm, ovipositor 3.7 mm long. (1, 2) Head and mesosoma brassy green; (3) gaster reddish dark brown with iridescent sheen; (4) scape, pedicel tan with remaining segments darker; (5) coxae concolorous with head and mesosoma; fore femur entirely dark brown, hind femur apically dark brown; remaining segments tan; (6) prosternum, mesosternum concolorous with notum.

(7) Head subprognathous, in frontal aspect longer than wide; compound eye not protuberant, or weakly so; (8) face and gena rugose, asetose; (9) vertex weakly sinuate seen from front; (10) antenna inserted at level of lower third of compound eye; (11) toruli nearly contiguous; (12) scrobe evanescent, lightly shagreened, extending to anterior ocellus; (13) interantennal ridge acute, short. (14) Antenna 13-segmented (Fig. 26); (15) scape elongate, setose, reaching anterior ocellus; (16) pedicel elongate, setose; (17) flagellar segments as long as wide, bearing more carinae than setae; setae irregularly dispersed, not verticillate; each seta with a distinct socket; (18) club distinct; terminal protuberance conspicuous. (19) Frons smooth; (20) clypeal margin trilobed, mesal lobe small; (21) mandible tridentate (Fig. 64), tooth margin sharply incised. (22) Maxillary palpus 2-segmented; palpifer evident; (23) palpiger not evident; (24) ligula with 4 sensory pegs; (25) paraglossa enveloping basal 3/4 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum as large as mesoscutum and scapulae combined, shagreened, sparsely setose; (28, 29) mesoscutum, scapula rugose; (30, 31) axilla, parascutellum weakly rugose; (32) mesoscutellum elutely shagreened; (33) meson of metanotum rugose, lateron with longitudinal plicae. (34) Forewing (Fig. 54) with submarginal vein 4 times as long as marginal vein; stigmal vein 2 times postmarginal vein; (35) stigma weakly tumid, sensilla evident; (36) dense cluster of adstigmal setae conspicuous; (37) marginal tract ending well before postmarginal vein; R_1 tract ending before marginal tract; submarginal tract not reaching stigma; distal, medial, and anal tracts absent. (38, 39) Coxae, femora all lightly sculptured; (40) middle and hind tibiae with 2 subequal apical spurs each; (41) fore basitarsus as long as tarsomeres 2-4; middle and hind basitarsal longer than tarsomeres 2-5. (42) Proepisternum as large as fore coxa, rugose, bearing 2 apparent cranial processes; (43) prosternum heart-shaped, shagreened; discrimen extending entire length; (44) prepectus laterally favose, mesally rugose; (45) mesepisternum laterally favose, mesally shagreened, smooth at discrimen; (46) mesepimeron rugose; (47) anapleurite smooth.

(48) Propodeum 3 times as wide as long, rugose, with pattern distorted laterally; median longitudinal carina weakly formed; (49) gaster ovoid, slightly larger than mesosoma; (50) tergum lightly shagreened, rear half of each tergum weakly setose, posterior margins straight; (51) sterna coriaceous; (52) ovipositor and gonostylus 2.5 times gastral length; (53) mesal surface of gonostylus setose basally, becoming sparsely setose distally.

Male—Body length 2.3 mm. (54, 55) Head and mesosoma chestnut; (56) gaster dirty white; (57) basal antennal segment dark reddish-brown, segment 2 tan, remaining segments dirty white; (58) coxae, femora concolorous with mesosoma; remaining segments castaneous.

(59) Head with dorsal surface lightly setose; clypeal margin with single conspicuous lobe; labiomaxillary complex represented by 2 large sensory pegs; (60)

mandible tridentate (Fig. 74), tooth margin sharply incised; third tooth weakly developed; (61) antenna 4-segmented (Fig. 43); segment 3 not translucent or collar-like; (62) all legs with 4 tarsomeres; tibio-tarsal complexes (Figs. 116-118) with basitarsi elongate; (63) each tergum bearing transverse row of long setae at center axis of plate; posterior tergal margins straight; (64) sterna smooth, asetose.

Material—Described from 27 females and 9 males collected at Turrialba, Cartago Province, Costa Rica by William Ramírez on 29 July 1964 from *Ficus cervantesiana*.

Holotype—A dissected female mounted in Hoyer's medium on 3 slides under 9 coverslips. Each label is inscribed: "*Idarnes bucatoma*. Turrialba, Cartago, Costa Rica. 29 July 1964, leg. W. Ramírez, ex. *Ficus cervantesiana*. HOLOTYPE." *Allotype*—One dissected male mounted in Hoyer's medium on 1 slide under 3 coverslips. The label is inscribed with the same data indicated above. *Paratypes*—Ten dissected females mounted in Hoyer's as the above holotype, with a similar label inscription.

Comparative Comments—This species is readily identifiable since the female antennal scape, pedicel, and second annulus are strongly setose (15, 16), the head is subprognathous (16), the pronotum (26) is exceedingly large; the adstigmal setae (37) of the forewing form a dense cluster, and the propodeum (46) is sculptured and bears a longitudinal carina. Males are recognized by the combination of tridentate mandible (60), 4 tarsomeres on each leg (62), and long tergal setae at the middle line of each plate, and straight posterior tergal margin (63).

Idarnes bucatoma does not appear closely related to any other *Idarnes* species, yet it clearly falls within the generic limits. The subprognathous head in the female presumably represents a derived character. The male is the only *Idarnes* which has a pigmented third antennal segment and 4-segmented tarsi.

Idarnes camini, new species

Female—Body length 1.4 mm, ovipositor 3.7 mm long. (1, 2) Head and mesosoma chestnut brown with sheen, margin of oral fossa light; (3) gaster brown with tawny luster, posterior margins of terga each bearing dark transverse band; (4) antenna tawny; (5) leg segments uniformly gold; (6) prosternum translucent, mesosternum concolorous with head and mesosoma.

(7) Head hypognathous; in frontal aspect nearly round; compound eye not protuberant; (8) face weakly rugose; gena strongly asetose; (9) vertex flat; (10) antenna inserted at middle line of compound eye; (11) toruli separated by diameter of single torulus; (12) scrobe cavity shallow, smooth, lateral walls carinate, extending to anterior ocellus; (13) interantennal ridge not acute. (14) Antenna 13-segmented (Fig. 33); (15) scape extending to vertex; (16) pedicel with few setae; (17) flagellomeres longer than wide, verticillate; setae inflexible, more numerous than carinae; (18) club present; terminal protuberance conspicuous. (19) Frons weakly shagreened, setose; (20) clypeal margin bilobed; (21) mandible tridentate (Fig. 67), tooth margin sharply incised. (22) Maxillary palpus 2-segmented; palpifer well formed; (23) palpiger not evident; (24) ligula with 2 sensory pegs; (25) paraglossa enveloping basal 1/2 of ligula; (26) galea moderately setose.

(27) Pronotum smaller than scapulae and mesoscutum, campanulate, uniformly shagreened; (28, 29) mesoscutum, scapula rugose; (30, 31) axilla, parascutellum strongly shagreened; (32) mesoscutellum lightly shagreened; (33) meson of metanotum smooth, lateron lightly sculptured. (34) Forewing (Fig. 55) with submarginal vein 3 times as long as marginal vein;

stigmal vein 3 times postmarginal vein; (35) stigma tumid, sensilla conspicuous; (36) 5 adstigmal setae; (37) marginal tract ending before postmarginal vein; R_1 tract extending to postmarginal vein; submarginal tract reaching stigma; discal, medial, anal tracts absent. (38) Fore and hind coxae lightly sculptured; (39) femora lightly setose; (40) middle tibia bearing 1 subapical spur; hind tibia setose, bearing 1 apical spur; (41) fore basitarsus as long as tarsomeres 2-5. (42) Proepisternum slightly larger than fore coxa, shagreened, bearing single cranial process; (43) prosternum triangular, smooth, setose along posterior margin; furca broadly attached to posterior margin of prosternum; (44) prepectus rugose; (45) mesepisternum laterally shagreened, smooth at discrimen; (46) mesepimeron weakly shagreened; (47) anapleurite smooth.

(48) Propodeum 3.5 times as wide as long, meson smooth, lateral region shagreened; (49) gaster ovoid; (50) terga shagreened, setose; posterior tergal margins straight; (51) sterna coriaceous; (52) ovipositor and gonostylus 3.5 times gaster length; (53) gonostylar setae along mesal surface large.

Male—Body length 1.1 mm. (54, 55) Head, mesosoma tan; mandible red; (56) gaster milky white; (57) antennal scape red; (58) legs straw colored.

(59) Head with long setae along posterior and lateral margins; (60) mandible (Fig. 79) bidentate with tooth margin sharply incised; (61) antenna (Fig. 38) 5-segmented; (62) legs with 5 tarsomeres (Figs. 98-100); middle and hind tibiae with single long apical spur; fore basitarsus short, middle and hind basitarsi spinose, elongate. (63) Gastral terga asetose, posterior margins sinuate; (64) sterna with minute setae.

Material—Described from 24 females and 3 males collected by William Ramírez at La Virgen, Heredia, Costa Rica on 31 May 1964 and 9 females and 2 males collected 15 June 1969 by the author and Ramírez 7.1 miles northeast of Coscomatepec, Veracruz, México. *Ficus oerstediana* Miquel was the host tree in both instances.

Ficus oerstediana is distributed throughout Mexico, Central America, and into Colombia.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 6 coverslips. Each label is inscribed: "*Idarnes camini*. La Virgen, Heredia, Costa Rica. 31 May 1964, leg W. Ramírez, ex. *Ficus oerstediana*. HOLOTYPE." *Allotype*—One dissected male mounted in Hoyer's medium on a single slide under 3 coverslips. The label is inscribed as is the holotype label. *Paratypes*—Eight dissected females mounted in the manner indicated above for the holotype. Each label is inscribed as above.

Variation—Some females have setae on the vertex (9); the frons may be smooth and glabrous (19); 4 ligular spines (24) and 4 adstigmal setae (36) may be present. The series of males was too small to show variation.

Comparative Comments—*Idarnes camini* females may be recognized by the combination of setose gena (8), distinctive antennal appearance (14-18), mesoscutum lightly shagreened (32), long postmarginal vein (34), and large setae on the gonostylus (53). Males are identifiable by the long setae on the head (59), bidentate mandible (60), 5-segmented antenna (61), and sinuous posterior tergal margins (63).

Idarnes carme Walker

Idarnes carme Walker, 1843, Ann. Mag. Nat. Hist. 12:47, ♀.

Female—Body length 1.5 mm, ovipositor 2.2 mm long. (1, 2, 3) Head, mesosoma, and gaster reddish brown with faint sheen; (4) antenna concolorous with head; (5) legs tan; (6) prosternum nearly yellow, mesosternum reddish brown.

(7) Head hypognathous, in frontal aspect distinctly wider than long; compound eye not protuberant; (8) face lightly setose, favose, pattern bolder toward vertex; gena setose, lacunose; (9) vertex flat; (10) antenna (Fig. 32) inserted at ventral margin of compound eye; (11) toruli separated by twice diameter of torulus; antennifer small; (12) scrobe evanescent, lacunose, not extending to anterior ocellus; (13) interantennal ridge setose, broad, nearly smooth; (14) antenna 12-segmented; (15) scape short, weakly setose; (16) pedicel not elongate, smooth, lightly setose; (17) flagellomeres longer than wide, longitudinal carinae more numerous than inflexible setae; (18) club weakly formed; terminal protuberance inconspicuous. (19) Frons smooth, setose; (20) clypeal margin straight; (21) mandible (Fig. 72) bidentate, tooth margin moderately incised. (22) Maxillary palpus 2-segmented; palpifer weak; (23) palpiger absent; (24) ligula with 4 sensory pegs; (25) paraglossa enveloping 3/4 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum with postero-dorsal surface favose, remainder shagreened; (28) mesoscutum favose; (29) scapula lacunose, weakly setose; (30, 31) axilla, parascutellum rugose; axilla weakly setose; (32) mesoscutellum lacunose, nearly smooth, lateral margin setose; (33) meson of metanotum lacunose, nearly smooth; lateron shagreened. (34) Forewing (Fig. 53) with submarginal vein 3 times as long as marginal vein; postmarginal vein over 2 times stigmal vein; (35) stigma tumid, sensillae large; (36) single adstigmal seta present; (37) marginal tract ending before postmarginal vein; R_1 tract short; submarginal tract reaching to stigma; discal, medial, and anal tracts absent. (38) Coxae all lightly shagreened, weakly setose; (39) femora lightly shagreened, weakly setose; (40) middle and hind tibiae each with single apical spur; (41) fore basitarsus as long as tarsomeres 2-3; middle and hind basitarsi as long as tarsomeres 2-4. (42) Proepisternum larger than forecoxa, shagreened, with single cranial process; (43) prosternum hemispherical, smooth; discrimen short; (44, 45) prepectus, mesepisternum laterally rugose, mesally smooth; (46) mesepimeron shagreened; (47) anapleurite smooth.

(48) Propodeum 3 times as wide as long, smooth; median longitudinal carina absent; (49) gaster as large as mesosoma; (50) terga lightly shagreened, setose; posterior tergal margins sinuate; (51) sterna smooth; (52) ovipositor and gonostylus 3 times gaster length; (53) gonostylus with setae along mesal surface, progressively more numerous distally.

Male—Body length 0.8 mm. (54, 55) Head, mesosoma tan; (56) gaster milky white; (57) antenna pale, nearly white; (58) legs concolorous with mesosoma, tibial margins red.

(59) Head with few short setae along dorsal surface; clypeal margin concave; (60) mandible (Fig. 73) bidentate, tooth margin not sharply incised; (61) antenna (Fig. 40) 4-segmented, with few setae; (62) all legs with 5 tarsomeres (Figs. 95-97); tibiae lacking long apical spurs; basitarsi elongate, with few apical spines. (63) Gastral terga asetose, posterior tergal margins straight; (64) sterna smooth, asetose.

Material—Redescribed from 6 females collected in part by H. H. Smith on St. Vincent and Barbados, West Indies (date of collection not indicated), and 27 females and 3 males collected by R. E. Beer on 10 April 1968 from the Florida Keys. In each instance the host tree was *Ficus aurea*.

Walker's type material should be in the British Museum (Natural History) but cannot now be located. Material borrowed from the U.S. National Museum of Natural History through the courtesy of B. D. Burks had been collected in the

West Indies and identified as *Idarnes carme* by Ashmead and Girault. Walker did not describe the male of this species, nor are any males present in the U.S. National Museum of Natural History from the West Indies. The females collected by Beer in Florida are considered conspecific with the material from the West Indies.

The epithet "aurea" has been used to describe varieties of *Ficus elastica* Roxburgh and *F. macrophylla* Desfontaines. However, these are not to be confused with *F. aurea* Nuttall, the Florida Strangling Fig. The species is found in southern Florida and the Bahamas, in addition to the West Indies.

Neotype—A dissected female mounted in Canada balsam on 2 slides with 3 coverslips each. Both labels are inscribed: "*Idarnes carme* Walker. St. Vincent, W. I., female, leg. H. H. Smith 209. NEOTYPE."

Variation—Some variation may be noted in the sculpturing of the female head (8) and mesosoma (28-33). Males were not collected in large enough numbers to detect variation.

Comparative Comments—*Idarnes carme* may be distinguished from other species by females with brunneous color (1, 2, 3), antenna inserted at level of ventral margin of compound eyes (10), shallow scrobe (12), setose interantennal ridge (13), mesosoma with setae on dorsal surface (29-32), and setae of the gonostylus becoming progressively more numerous distally (53). Males have a bidentate mandible (60), 4-segmented antenna (61), and straight posterior tergal margins (63).

Idarnes coriaria (Mayr)

Tetragonaspis coriaria Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:209.

This species was adequately described by Mayr from Brazilian material collected by Fritz Müller. The male remains undescribed and the *Ficus* host is unknown. The species belongs in *Idarnes* as here limited but differs from the more northern species described herein.

Idarnes flavicollis (Mayr)

Tetragonaspis flavicollis Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:207-208, ♀.

Ganosoma robustum Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:204, ♂.

Female—Body length 2.5 mm, ovipositor 5.0 mm long. (1, 2) Head, mesosoma metallic dark green; (3) gaster smoky brown; (4) scape basally tan, becoming progressively darker distally; pedicel and remaining segments reddish brown; (5) fore and hind coxae tawny brown; remaining leg segments dirty white; (6) prosternum, mesosternum concolorous with head and mesosoma.

(7) Head hypognathous, in frontal aspect oval, nearly round; (8) face progressively more rugose above toruli; vertex favose; gena rugose along margin of compound eye, remainder smooth; genal surface setose; (9) vertex convex; (10) antenna (Fig. 29) inserted just below midline of compound eye; (11) toruli separated by 1.5 times diameter of torulus; (12) scrobe shallow, glabrous, terminated at anterior ocellus; (13) interantennal ridge short. (14) Antenna 13-segmented; (15) scape setose, shagreened, extending beyond vertex; (16) pedicel not elongate, setose; (17) flagellomeres longer than wide, verticillate, with flexible setae; (18) club not distinct; terminal protuberance conspicuous. (19) Frons smooth, asetose; (20) clypeal margin bilobed; (21) mandible tridentate (Fig. 69), tooth margin not sharply incised. (22) Maxillary palpus 2-segmented; palpifer evident; (23) palpiger evident; (24) ligula with 4 sensory pegs; (25) paraglossa enveloping 2/3 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum with postero-dorsal surface rugose, remainder shagreened; (28, 29, 30, 31) mesoscutum, scapula, axilla, parascutellum uniformly rugose; (32) mesoscutellum shagreened with pattern lightly incised; lateral margin asetose;

(33) meson of metanotum rugose, lateron smooth, setose. (34) Forewing (Fig. 48) with submarginal vein 3 times as long as marginal vein; stigmal vein 2 times postmarginal vein; (35) stigma tumid with large sensillae; (36) adstigmal setae variable; (37) marginal tract ending at postmarginal vein; R_1 tract absent; submarginal tract reaching stigma; discal, medial, anal tracts absent; (38) all coxae sculptured, setose; (39) femora setose; hind femur and coxa subequal in size; (40) middle tibia with single apical spur; hind tibia with 2 subequal apical spurs; (41) fore basitarsus as long as tarsomeres 2-3; middle basitarsus longer than remaining tarsomeres; hind basitarsus as long as tarsomeres 2-5. (42) Proepisternum as large as fore coxa, asetose, rugose, bearing single elongate cranial process; (43) prosternum subtrapezoidal, rugose; discrimen extending to center; (44) prepectus laterally rugose, pattern fading mesally; (45) mesepisternum uniformly shagreened; spinasternum smooth, well developed; (46) mesepimeron laterally rugose, shagreened at pleural suture; (47) anapleurite smooth.

(48) Propodeum 3 times as wide as long, smooth; area antero-lateral to spiracles setose; median longitudinal carina absent; (49) gaster larger than head and mesosoma combined; (50) terga lightly shagreened; posterior half of each tergum uniformly setose; posterior tergal margins straight; (51) sterna smooth, glabrous; (52) ovipositor 4.5 times gaster length; (53) gonostylus with few small setae along mesal surface.

Male—Body length 1.9 mm. (54, 55) Head, mesosoma tan; (56) gaster pale, nearly dirty white; (57) antenna tan; (58) legs concolorous with mesosoma, tibial margins reddish.

(59) Dorsal surface of head smooth; clypeal margin weakly concave; (60) mandible tridentate (Fig. 75), front tooth margin sharply incised; (61) antenna (Fig. 47) 5-segmented; (62) each leg with 5 tarsomeres; tibio-tarsal complex (Figs. 92-94) with fore basitarsus short, middle and hind tibiae with long spurs. (63) Gastral terga asetose, posterior margins straight; (64) sterna smooth.

Material—Twenty-one female and 8 male wasps collected at La Cañada, Cartago, Costa Rica by William Ramírez on 31 January 1963 from *Ficus velutina* Willd.

Comparative Comments—Superficially this species resembles *Idarnes simus,* but it may be distinguished on the basis of the following female characters: *I. flavicollis* has a rugose face (8), the antenna 13-segmented (14), frons asetose (19), lateral margin of mesoscutellum asetose (32), lateron of metanotum setose (33), the stigmal vein twice as long as the postmarginal vein (34), the prosternum subtrapezoidal in shape (43), the anapleurite smooth (47), and the posterior tergal margins straight (50).

Mayr (1885) described *Ganosoma robustum* from Brazil as developing in receptacles of the same tree as *Idarnes flavicollis.* The material from Costa Rica reveals two distinct male morphs, neither of which conforms to *G. robustum* very well. The marked male dimorphism may be due to nutrition, which could also account for the discrepancy between the material examined from Costa Rica and Mayr's *G. robustum.* Since the larger form is more common, and since the smaller form could conceivably be the male of another symbiont, I have described above only the larger of the two morphs. The problem of association of sexes is still not satisfactorily solved, and the Costa Rican material may represent a new species. The female from Costa Rica, however, agrees with *I. flavicollis* from Brazil.

Mayr failed to give the species of fig from which *Idarnes flavicollis* emerged. *Ficus velutina* Willd. if found throughout

Central America, but it is uncertain whether or not it grows in South America.

Type Locality—Santa Catarina, Brazil.

Idarnes forticornis (Mayr)

Tetragonaspis forticornis Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:208, ♀.

This species was described from material collected in Brazil. The male remains undescribed and the *Ficus* host unrecorded. This is a species of *Idarnes* as here restricted.

Idarnes galbina, new species

Female—Body length 1.0 mm, ovipositor 1.9 mm long. (1, 2, 3) Head, mesosoma, gaster shining brown; (4) antenna concolorous with body; (5) legs uniformly straw colored; (6) prosternum chestnut brown; mesosternum shining brown.

(7) Head hypognathous, in frontal aspect nearly round; compound eye weakly protuberant; (8) face shagreened at toruli, pattern becoming progressively bolder toward vertex; (9) vertex convex; gena hispidous, smooth; (10) antenna inserted just below midline of compound eye; (11) toruli separated by 2 times torulus diameter; (12) scrobe cavity short, not reaching anterior ocellus; lateral walls carinate; (13) interantennal ridge broad, flat. (14) Antenna 12-segmented (Fig. 31); (15) scape weakly setose, smooth, reaching lower margin of anterior ocellus; (16) pedicel with very few setae; (17) flagellomeres as long as wide, carinae long; carinae more numerous than setae; (18) club nearly absent; terminal protuberance not conspicuous. (19) Frons lightly shagreened, marginally setose; (20) clypeal margin convex; (21) mandible bidentate (Fig. 68), tooth margin not sharply incised. (22) Maxillary palpus 2-segmented; palpifer not evident; (23) palpiger not evident; (24) ligula with 2 sensory pegs; (25) paraglossa enveloping entire ligular margin; (26) galea with few acuminate setae.

(27) Pronotum lightly shagreened; (28) mesoscutum favose along scuto-scutellar suture, pattern distorted cephalad; (29, 30, 31) axilla, scapula, parascutellum rugose; (32) mesoscutellum glabrous; (33) meson of metanotum lacunose, lateron weakly sculptured. (34) Forewing (Fig. 50) with submarginal vein 3 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma not tumid, sensillae small; (36) 2 adstigmal setae; (37) marginal tract ending at postmarginal vein; R_1 tract present, ending behind postmarginal vein; submarginal tract not reaching stigma; discal, anal tracts absent; medial tract present. (38) Fore coxa lightly shagreened, hind coxa rugose; (39) femora shagreened, setose; (40) middle tibia with medial setal tract, single apical spur; hind tibia bearing setal tract, several subequal apical spurs; (41) fore basitarsus as long as tarsomeres 2-3; middle and hind basitarsi as long as tarsomeres 2-4. (42) Proepisternum as large as fore coxa, glabrous, bearing single elongate cranial process; (43) prosternum nearly round, glabrous; discrimen only at base of structure; (44) prepectus rugose; (45) mesepisternum shagreened, pattern evanescent at discrimen; (46) mesepimeron uniformly shagreened; (47) anapleurite smooth.

(48) Propodeum 5 times as wide as long, lacunose; median longitudinal carina absent; (49) gaster ovoid; (50) posterior tergal margins sinuate; each tergum with transverse row of small, inconspicuous setae; (51) sterna smooth; (52) ovipositor and gonostylus 2.5 times gaster length; (53) gonostylus with setae becoming progressively longer, more numerous distally.

Male—Body length 0.9 mm. (54, 55) Head and mesosoma chestnut; (56) gaster dirty white; (57) scape light tan, club white; (58) all leg segments concolorous with head and mesosoma.

(59) Head with postero-dorsal surface setose; clypeal margin sinuate; (60) man-

dible tridentate (Fig. 77), tooth margin moderately incised; (61) antenna 4-segmented (Fig. 37), inserted at base of mandible; segment 3 translucent, collar-like; lateral walls of scape not thick; (62) all legs with 5 tarsomeres; tibio-tarsal complexes (Figs. 86-88) as figured; (63) each tergum bearing transverse row of very long setae; posterior tergal margins sinuate; (64) sterna smooth.

Material—Described from 42 females and 16 males collected at Puerto Viejo, Heredia, Costa Rica, by William Ramírez on 16 May 1964 from *Ficus colubrinae*.

Holotype—A dissected female mounted in Hoyer's medium on 2 slides, each bearing 3 coverslips. Both labels are inscribed: "*Idarnes galbina*. Puerto Viejo, Heredia, Costa Rica. 16 May 1964, leg. W. Ramírez, ex. *Ficus colubrinae*. HOLOTYPE." *Allotype*—A single male, dissected, on 1 slide with the parts under 3 coverslips. The inscription on the label is the same as above. *Paratypes*—Eight females, Canada balsam or Hoyer's medium, mounted in the manner indicated above for the holotype, with a similar label inscription.

Variation—While this species is exceedingly small, occasionally a large (1.4 mm) female may be found; the antennal scape may bear some setae (15), the ligula has a variable number of sensory pegs (24), and the mesoscutellum may bear a shagreened sculpture pattern (32). Males also exhibit some variation in size, and in setal number on the antennal club (61).

Comparative Comments—This species of *Idarnes* may be distinguished from others on the basis of the following key female characters: smooth, hispidous gena (8), 12-segmented antenna (13), flagellomeres with more carinae than setae (17), clypeal margin convex (20), mesoscutum with distorted favose sculpture (28), medial vein tract present (37), and a thin, transverse, lacunose propodeum. Males may bear long setae on the dorsum of the head (59), and antenna (61) may appear 5-segmented, with the base of the club constricted.

Idarnes galbina seems most closely related to *I. carme*. The female antennae of both species are similar, the sculpturing patterns of the mesosoma overlap, and the labiomaxillary complexes resemble one another.

Idarnes gracilicornis (Mayr)

Ganosoma attenuatum Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:204, ♂.

Tetragonaspis gracilicornis Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:208, ♀.

Ashmead (1904) originally associated the female *T. gracilicornis* with the male *G. attenuatum*, but offered no reason for doing so. Thus some question remains as to the correct association between the species synonomized under *I. gracilicornis*. I have not had an opportunity to examine the material Ashmead used and from the original descriptions it is not possible to correctly associate the sexes.

Idarnes jimenezi, new species

Female—Body length 2.1 mm, ovipositor 2.3 mm long. (1, 2) Head, mesosoma dark metallic green; (3) gaster rusty red; (4) antenna reddish brown; (5) coxae concolorous with mesosoma; remaining leg segments tan; (6) prosternum gold.

(7) Head hypognathous, in frontal aspect nearly round; eye weakly protuberant; (8) vertex favose, pattern evanescent over remainder of head; setae irregularly dispersed over face; (9) margin of vertex strongly sinuate; (10) antenna inserted at ventral margin of compound eye; (11) toruli separated by diameter of torulus; (12) scrobe cavity deep, lacunose, lateral margins carinate; (13) interantennal ridge acute. (14) Antenna 12-segmented (Fig. 36); (15) scape extending to anterior ocellus; (16) pedicel not elongate, setose; (17) flagellomeres slightly longer than wide, verticillate, setae inflexible; setae, carinae equal in number; (18) club absent; ter-

minal protuberance inconspicuous. (19) Frons favose, glabrous; (20) clypeal margin straight; (21) mandible bidentate (Fig. 65), tooth margin deeply incised. (22) Maxillary palpus 2-segmented; palpifer small; (23) palpiger not evident; (24) ligula very reduced, bearing 2 sensory pegs; (25) paraglossa enveloping basal 3/4 of ligular margin; (26) galea with moderate number of acuminate setae.

(27) Pronotum favose along posterodorsal margin; (28) mesoscutum rugose, pattern evanescent along posterior margin near scapula; (29, 30) scapula, axilla shagreened; (31) parascutellum rugose; (32) mesoscutellum smooth; (33) meson of metanotum rugose, lateron smooth. (34) Forewing (Fig. 59) with submarginal vein 3 times as long as marginal vein; postmarginal vein 1.5 times stigmal vein; (35) stigma tumid, with small sensilla; (36) 2 adstigmal setae; (37) marginal tract ending at postmarginal vein; R_1 tract absent; submarginal tract not reaching stigma; discal tract absent; medial, anal tracts present. (38, 39) Coxae, femora shagreened, setose; (40) middle tibia with single apical spur; hind tibia with 2 subequal large apical spurs; (41) fore basitarsus as long as tarsomeres 2-3; middle basitarsus as long as tarsomeres 2-4; hind basitarsus as long as tarsomeres 2-3. (42) Proepisternum as large as fore coxa, shagreened, bearing single cranial process; (43) prosternum semicircular, glabrous; discrimen long; (44) prepectus rugose, pattern evanescent mesally; (45) mesepisternum shagreened, pattern absent at discrimen; (46) mesepimeron rugose; (47) anapleurite smooth.

(48) Propodeum 3 times as wide as long, meson favose, lateral regions smooth; median longitudinal carina absent; (49) gaster larger than head and thorax; (50) tergum glabrous, posterior tergal margins sinuate; (51) sterna glabrous; (52) ovipositor and gonostylus 2.5 times gaster length; (53) gonostylus glabrous or bearing minute setae mesally.

Male—Body length 1.8 mm. (54, 55) Head and mesosoma amber; (56) gaster white; (57) scape, pedicel reddish brown; segment 3 translucent; remaining segments tan. (58) Coxae concolorous with mesosoma; tibiae lacteous.

(59) Head with short setae; clypeal margin arched inward, with single large mesal spine; (60) mandible (Fig. 78) scythe-like, bidentate, tooth margin sharply incised; (61) antenna (Fig. 41) 4-segmented, basal part of segment 4 nearly a distinct segment; (62) all legs with 5 tarsomeres; tibio-tarsal complexes as figured (Figs. 110-112), basitarsi with apical spines. (63) Each tergum bearing a few long setae; posterior margins sinuate; (64) sterna smooth, asetose.

Material—Described from 31 females and 6 males collected by William Ramírez on 24 August 1964 at Santa Domingo, Heredia, Costa Rica from *Ficus jimenezii*.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 6 coverslips. Each label is inscribed: "*Idarnes jimenezi*. Santa Domingo, Heredia, Costa Rica. 24 August 1964, leg. W. Ramírez, ex. *Ficus jimenezii*. HOLOTYPE." *Allotype*—A dissected male mounted in Hoyer's medium under 3 coverslips on 1 slide. The label is inscribed as indicated above. *Paratypes*—Eight dissected females each mounted on 1 slide under 3 coverslips in Canada balsam. Each label is inscribed as indicated above.

Variation—Variations in the facial sculpturing pattern (8, 19), setae on the coxae and femora (38, 39), and propodeal sculpture pattern (48) are exhibited by females. Males were not collected in large enough numbers to determine the extent of variation.

Comparative Comments—Females may be distinguished from other species of *Idarnes* on the basis of the following char-

acters: antennal configuration (14-18), mesoscutellum smooth (32), and the presence of an anal vein tract (37). All males examined have the scythe-like mandible (60) and a 4-segmented antenna (61) in which the club base is constricted.

Idarnes micheneri, new species

Female—Body length 1.8 mm, ovipositor 3.9 mm long. (1, 2, 3) Head, mesosome, gaster brassy green; margin of oral fossa tan; (4) antenna uniformly dark brown; (5) all coxae, hind femur shining brown; remaining segments tan; (6) prosternum, mesosternum fusco-rufeous.

(7) Head verging on prognathous, in frontal aspect nearly round; (8) face progressively more rugose above toruli; gena smooth, setose; (9) vertex weakly convex; (10) antenna inserted just above ventral margin of compound eye; (11) toruli separated by twice diameter of torulus; (12) scrobe cavity moderately deep, extending to anterior ocellus at level of upper 1/3 of compound eye; (13) interantennal ridge not acute. (14) Antenna (Fig. 27) 13-segmented; (15) scape lightly setose, extending to anterior ocellus; (16) pedicel lightly setose, elongate; (17) flagellomeres as long as wide, verticillate, setae inflexible; (18) club present; terminal protuberance not conspicuous. (19) Frons smooth, often lateral margin setose; (20) clypeus trilobed; (21) mandible tridentate (Fig. 60), tooth margin not sharply incised. (22) Maxillary palpus 2-segmented; palpifer conspicuous; (23) palpiger large; (24) ligula with 4 sensory pegs; (25) paraglossa enveloping basal 1/3 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum postero-dorsally rugose, remainder shagreened; (28, 29) mesoscutum, scapula rugose; (30, 31) axilla, parascutellum shagreened; (32) mesoscutellum eleutely shagreened; (33) meson of metanotum shagreened, lateron smooth. (34) Forewing (Fig. 58) with submarginal vein 3 times as long as marginal vein; stigmal vein 2 times postmarginal vein; (35) stigma tumid, sensillae conspicuous; (36) 3 adstigmal setae present; (37) marginal tract reaching postmarginal vein; R_1 tract ending behind postmarginal vein; submarginal tract reaching stigma; discal tract conspicuous; medial, anal tracts absent. (38) Fore and hind coxae shagreened; hind coxa larger than hind femur; (39) femora setose, lightly shagreened; (40) middle and hind tibiae each with 2 subequal apical spurs; hind tibia with setal tract, large apical spurs; (41) fore basitarsus as long as tarsomeres 2-3; middle and hind basitarsi as long as tarsomeres 2-5 of respective legs. (42) Proepisternum larger than fore coxa, weakly shagreened, setose along posterior margin, bearing single elongate cranial process; (43) prosternum campanulate, shagreened, setose; discrimen extending cephalad 1/4 length of structure; (44) prepectus rugose; (45) mesepisternum shagreened; (46) mesepimeron rugose; (47) anapleurite smooth.

(48) Propodeum 3 times as wide as long, eleutely shagreened, median longitudinal carina absent; (49) gaster 2.5 times longer than wide; (50) terga lightly setose, strongly shagreened; posterior tergal margins straight; (51) sterna coriaceous; (52) ovipositor and gonostylus 3.5 times gaster length; (53) gonostylus bearing long conspicuous setae.

Male—Body length 1.4 mm. (54, 55) Head and mesosoma tan; (56) gaster white; (57) scape, pedicel tan with margin reddish; (58) coxae, femora concolorous with mesosoma; remaining segments reddish.

(59) Head with long conspicuous setae; clypeal margin concave; (60) mandible tridentate (Fig. 76), tooth margin sharply incised; (61) antenna 4-segmented (Fig. 46); base of club nearly separated from distal portion; (62) all legs with 5 tarsomeres (Figs. 104-106); middle and hind tibiae each with 1 long apical spur;

basitarso spinose; (63) all terga smooth, setose, posterior margins sinuate; (64) sterna smooth, lightly setose.

Material—Described from 83 females and 12 males collected by William Ramírez at Ciruelas, Alajuela, Costa Rica on 20 August 1964 from *Ficus isophlebia*.

Ficus isophlebia is related to *F. jimenezii* according to Standley (1917). Both species of *Ficus* grow throughout Central America and northward into México.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 6 coverslips. Each label is inscribed: "*Idarnes micheneri*. Ciruelas, Alajuela, Costa Rica. 20 August 1964, leg. W. Ramírez, ex. *Ficus isophlebia*. HOLOTYPE." *Allotype*—One dissected male mounted in Hoyer's medium on 1 slide under 3 coverslips. The label is inscribed as indicated above. *Paratypes*—Eight dissected females mounted in Canada balsam or Hoyer's medium, each on 2 slides under 6 coverslips. Each label is inscribed as above.

Variation—Some female wasps from México have the hind coxae and femora bronze (4), the genae shagreened (7), a minute mesal clypeal lobe (20), and fewer than 4 adstigmal setae (36). Males sometimes have a setose pronotum and some variation in the development of setae on the sternum of the gaster (64).

Comparative Comments—Idarnes micheneri females may be recognized by the rugose face (8), 13-segmented antenna (14), smooth, setose frons (19), tridentate mandible (21), large labial palpiger (23), well developed submarginal and discal vein tracts (37), straight posterior tergal margin (50), and long, conspicuous gonostylar setae (53). Males can be recognized by the tridentate mandible (60), 4-segmented antenna (61), and lightly setose gastral sterna (64).

Idarnes obtusifoliae, new species

Female—Body length 2.4 mm, ovipositor 7.0 mm long. (1, 2) Head and mesosoma brassy green; (3) gaster chestnut brown; (4) antenna uniformly shining brown; (5) coxal bases brassy green, legs otherwise dirty white; (6) prosternum castaneous; mesosternum concolorous with head and mesonotum.

(7) Head hypognathous, in frontal aspect slightly wider than long; compound eye not protuberant; (8) face asetose, uniformly favose; gena favose; (9) vertex sinuous; (10) antenna inserted just above ventral margin of compound eye; (11) toruli separated by 3 times diameter of torulus; antennifer conspicuous; (12) scrobe with 2 shallow channels, favose; lateral walls not carinate; (13) interantennal ridge not acute. (14) Antenna 12-segmented (Fig. 30); (15) scape shagreened, setose, elongate, but not reaching vertex; (16) pedicel shagreened, setose; (17) flagellomeres 1.5 times as long as wide, verticillate; setae inflexible, more numerous than carinae; (18) club absent; terminal protuberance evident. (19) Frons favose; (20) clypeus bilobed, meson incised; (21) mandible tridentate (Fig. 62), tooth margin sharply incised. (22) Maxillary palpus 2-segmented; palpifer evident; (23) palpiger not evident; (24) ligula with 2 sensory pegs; (25) paraglossa enveloping entire margin of ligula; (26) galea with numerous acuminate setae.

(27) Pronotum with postero-dorsal surface favose, remainder shagreened; (28, 29, 30, 31) mesoscutum, scapula, axilla, parascutellum lacunose; (32) mesoscutellum lacunose; (33) meson of metanotum favose, lateral regions with numerous parallel plicae. (34) Forewing (Fig. 52) with submarginal vein 4 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma tumid, sensilla small; (36) 1 adstigmal seta present; (37) marginal tract not extending to postmarginal vein; R_1 tract absent; submarginal tract reaching stigma; medial tract present; discal, anal tracts absent. (38) Fore

and middle coxae mesally setose; hind coxa asetose; (39) middle femur shorter than middle tibia; hind femur setose; (40) middle tibia with single apical spur; hind tibia with 2 mesal, longitudinal setal tracts, 2 subequal apical spurs; (41) fore basitarsus as long as tarsomere 2; middle basitarsus as long as tarsomeres 2-5; hind basitarsus as long as tarsomeres 2-4. (42) Proepisternum smaller than fore coxa, rugose, bearing single elongate cranial process; (43) prosternum oval, glabrous, lightly setose; discrimen extending along basal third of structure; (44) prepectus favose; (45) mesepisternum laterally favose, smooth at discrimen; (46) mesepimeron rugose; (47) anapleurite favose.

(48) Propodeum 4 times as wide as long, lacunose; medial longitudinal carina present; (49) gaster ovoid; (50) tergum shagreened, small setae irregularly distributed; posterior margin of each tergum sinuate; (51) sterna smooth; (52) ovipositor and gonostylus 8 times gaster length; (53) gonostylus with small setae along mesal surface.

Male—Body length 2.1 mm. (54, 55) Head and mesosoma tan; (56) gaster milky white; (57) scape tan with margin reddish; segments 2, 4, and 5 tan; (58) coxae, femora concolorous with mesosoma; tibiae, tarsomeres reddish.

(59) Head prognathous; lateral margin with short, inconspicuous setae; (60) mandible bidentate (Fig. 70), not scythe-like, tooth margin not sharply incised; (61) antenna 4-segmented (Fig. 45); clypeal margin flexed inward; (62) all legs with 5 tarsomeres; tibio-tarsal complexes (Figs. 101-103) with elongate basitarsi, apical basitarsal spines; (63) all gastral terga smooth, setose; posterior margins sinuate; (64) sterna smooth.

Material—Described from over 100 females and 38 males collected by William Ramírez at Playon Aguirre, Puntarenas Province, Costa Rica on 15 August 1964 from *Ficus obtusifolia* H. K. B.; by the author and Ramírez from Coiclagus, Veracruz, México, 11 August 1969 on *Ficus obtusifolia;* and by the author at El Salto, San Luis Potosí, México, 12 June 1970, also from *Ficus obtusifolia.*

Ficus obtusifolia ranges throughout México and Central America. DeWolf (1960) indicates *Ficus bonplandiana* (Liebm.) Miquel is a synonym of *Ficus obtusifolia* H. B. K. The association between *Ficus obtusifolia* and *Idarnes obtusifoliae* appears to be one of the better documented examples of host specificity between torymid and fig, since the wasp has been collected from this host at 3 widely separated localities on 3 separate occasions.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 6 coverslips. Each label is inscribed: "*Idarnes obtusifoliae.* Playon Aguirre, Costa Rica. 15 August 1964, leg. W. Ramírez, ex. *Ficus obtusifolia.* HOLOTYPE." This locality is inland from Parrita, Puntarenas Province. *Allotype*—A dissected male mounted on 1 slide under 3 coverslips in the manner indicated above and similarly labeled. *Paratypes*—Eight dissected females slide-mounted in the manner indicated for the holotype above, with labels inscribed in a similar manner.

Variation—Females from México sometimes have a unilobed clypeus (20), antennae inserted a little higher on the head (10), head with flat vertex (9), and the propodeal carina absent (48).

Comparative Comments—Idarnes obtusifoliae may be easily recognized by the following combination of female characters: Head uniformly favose (8), toruli widely separated (11), 12-segmented antenna (14), flagellomeres as illustrated (17), and forewing with medial setal tract (37). Males are difficult to separate from other species since some have a scythe-like mandible (60), and some have an an-

tenna that appears 5-segmented (61). Several large setae are arranged in transverse rows along each tergum (63) and appear to be a distinctive, constant male character.

Idarnes oscrocata, new species

Female—Body length 1.9 mm, ovipositor 5.0 mm long. (1, 2) Head and mesosoma brassy green; margin of oral fossa tan, extending to occipital foramen; (3) gaster brown; (4) scape tan with luster; pedicel brunneous; remaining antennal segments bronze; (5) all leg segments tan; (6) prosternum tan.

(7) Head hypognathous, in frontal aspect wider than long; compound eye moderately protuberant; (8) head above toruli favose; gena lacunose, weakly setose; (9) vertex flat; (10) antenna inserted at midline of compound eye; (11) toruli separated by twice diameter of torulus; antennifer conspicuous; (12) scrobe cavity deep, favose, lateral walls carinate; (13) interantennal ridge acute, short. (14) Antenna 12-segmented (Fig. 35); (15) scape asetose, elongate, extending to vertex; (16) pedicel asetose, 2 times longer than maximum width; (17) flagellomeres 1.5 times longer than wide; (18) club present but weak; terminal protuberance conspicuous. (19) Frons smooth, setose; (20) clypeal margin straight; (21) mandible bidentate (Fig. 66), tooth margin moderately incised. (22) Maxillary palpus 2-segmented; palpifer evident; (23) palpiger not evident; (24) ligula elongate with 4 sensory pegs; (25) paraglossa enveloping 2/3 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum postero-dorsally favose, remainder shagreened; (28, 29, 30, 31) mesoscutum, scapula, axilla, parascutellum favose; (32) mesoscutellum lacunose; (33) meson of metanotum favose, lateron with numerous longitudinal plicae. (34) Forewing (Fig. 57) with submarginal vein 3.5 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma tumid, sensilla small; (36) 3 adstigmal setae present; (37) marginal tract with few microtrichae, ending well before terminus of postmarginal vein; R_1 tract absent; submarginal tract reaching stigma; discal, medial, anal tracts absent. (38) Fore and hind coxae sculptured; middle coxa smooth; (39) femora setose, hind femur smaller than hind coxa; (40) middle tibia with single apical spur; hind tibia with 2 subequal apical spurs; (41) fore basitarsus slightly longer than tarsomere 2; middle basitarsus as long as tarsomeres 2-5; hind basitarsus as long as tarsomeres 2-4. (42) Proepisternum bronze, rugose, slightly smaller than fore coxa, bearing single elongate cranial process; (43) prosternum heart-shaped, smooth, setose on posterior quarter; (44) prepectus favose laterally, smooth mesally; (45) mesepisternum rugose laterally, shagreened mesally; (46) mesepimeron smooth along pleural suture, laterally rugose; (47) anapleurite rugose.

(48) Propodeum 3 times as wide as long, glabrous, asetose; median longitudinal carina absent; (49) gaster slightly larger than head and mesosoma combined; (50) terga lightly shagreened, posterior margins sinuate; (51) sterna coriaceous; (52) ovipositor and gonostylus 6 times gaster length; (53) gonostylus bearing small inconspicuous setae along mesal surface.

Male—Body length 1.5 mm. (54, 55) Head, mesosoma tan; (56) gaster light tan, nearly white; (57) antenna pale; (58) all leg segments concolorous with mesosoma; tibial spines amber.

(59) Head with dorsal surface lightly setose; clypeal margin concave, bearing 2 small mesal spines; (60) mandible bidentate (Fig. 82), tooth margin not sharply incised; large spines on mesal surface of mandible; (61) antenna (Fig. 42) 5-segmented; (62) all legs with 5 tarsomeres; tibio-tarsal complexes (Figs. 113-115) with

tibiae lacking apical spurs; basitarsi lacking thickened walls; (63) terga smooth, asetose; posterior tergal margins sinuate; (64) sterna smooth, asetose.

Material—Described from 6 females collected on 6 August 1969 and 87 females and 4 males collected on 20 August 1969, 2 miles north of Izucar de Matamoros, Puebla, México, along the Rio Balsas, by the author and William Ramírez. In both instances the host tree was *Ficus goldmanii*.

Ficus goldmanii Standley ranges throughout México and into Central America. In Puebla this species grows in a riparian situation; in Sinaloa it was observed growing in a xeric habitat. *Idarnes* was not recovered from figs taken in Sinaloa.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 6 coverslips. Each label is inscribed: "*Idarnes oscrocata*. 2 mi. N. Izucar de Matamoros, Puebla, México. 20 August 1969, leg. Gordh and Ramírez, ex. *Ficus goldmanii*. HOLOTYPE." *Allotype*—One dissected male mounted in Hoyer's medium under 3 coverslips on a single slide, with the label inscribed as indicated above. *Paratypes*—Eight dissected females, each on one slide under 3 coverslips in Canada balsam.

Variation—Some females have 2 sensory pegs on the ligula (24), the frons may be lacunose (19), the medial vein tract is sometimes obscure (37), the metanotal meson may be lacunose (33), and the propodeum may be mesally and postero-laterally rugose (48). Aside from the fourth antennal segment being nearly fused to the club (61), little variation was detected in males.

Comparative Comments—Females of this species may easily be recognized by the conspicuous tan margin of the oral fossa (1), straight clypeal margin (20), elongate ligula with 4 sensory pegs (24), medial vein tract (37), rugose anapleurite (47) and coriaceous sterna (51). Males are identifiable by their bidentate mandible (60), 5-segmented antenna (61), and asetose terga with sinuate posterior margins (63).

Idarnes oscrocata appears most closely related to *I. obtusifoliae* and may be distinguished from that species on the basis of facial sculpture pattern (8), and clypeal margin conformation (20).

Idarnes parallela (Mayr)

Ganosoma parallelum Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:204, ♂.

The female of *I. parallela* remains undescribed. From the original description by Mayr, it is not possible to state with certainty that a synonymy has not been made in the present work or that a previously described species is not synonymous with *I. parallela*. Until further collections have been made in Brazil and *I. parallela* females are collected and associated with the males, positive statements regarding the taxonomic status of *I. parallela* cannot be made.

Idarnes punctata (Mayr)

Tetragonaspis punctata Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:209, ♀.

The female of this species was adequately described by Mayr, but the male remains undescribed. It is a species of *Idarnes* as here restricted, from Brazil.

Idarnes simus, new species

Female—Body length 2.0 mm, ovipositor 6.2 mm long. (1, 2) Head, mesosoma bright metallic green; margin of oral fossa pale; (3) gaster dorsally tawny; sterna tan with pale transverse stripes; (4) scape brownish yellow, remaining segments chestnut brown; (6) prosternum tan; mesosternum pale at discrimen, remainder concolorous with head and mesonotum.

(7) Head hypognathous, in frontal aspect slightly wider than long; compound eye not protuberant; (8) face favose above

level of toruli; gena smooth, strongly setose; (9) vertex weakly sinuate; (10) antenna inserted at lower third of compound eye; antennifer conspicuous; (11) toruli separated by 3 times diameter of torulus; (12) scrobe nearly absent, 2 widely separated channels, short, smooth; (13) interantennal ridge broad, not acute. (14) Antenna (Fig. 34) 13-segmented; (15) scape elongate, setose, extending to vertex; (16) pedicel not elongate, bearing few setae; (17) flagellomeres 2 times as long as wide, verticillate; setae flexible, more numerous than carinae; (18) club absent; terminal protuberance conspicuous. (19) Frons smooth, setose; (20) clypeal margin straight; (21) mandible bidentate, tooth margin sharply incised. (22) Maxillary palpus 2-segmented; palpifer small; (23) palpiger not evident; (24) ligula with 2 sensory pegs; (25) paraglossa enveloping basal 2/3 of ligular margin; (26) galea with numerous acuminate setae.

(27) Pronotum postero-dorsally favose, remainder shagreened, pattern lightly incised; (28, 29, 30, 31) mesoscutum, scapula, axilla, parascutellum favose; (32) scutellum lacunose, nearly smooth; (33) meson of metanotum favose, lateron bearing several longitudinal plicae. (34) Forewing (Fig. 49) with submarginal vein 3 times as long as marginal vein; postmarginal vein 2 times stigmal vein; (35) stigma tumid, sensilla small; (36) 2 adstigmal setae; (37) marginal tract ending at postmarginal vein; R_1 tract absent; submarginal tract ending at stigma; discal, medial, anal tracts absent. (38) Fore and hind coxae lightly shagreened; (39) femora shagreened, setose; (40) middle tibia heavily setose, bearing single apical spur; hind tibia with setal tract, 2 subequal apical spurs; (41) fore basitarsus as long as tarsomeres 2-3; middle basitarsus longer than remaining tarsomeres; hind basitarsus as long as tarsomeres 2-4. (42) Proepisterna smaller than fore coxa, shagreened, bearing setae basally, single wide cranial process; (43) prosternum nearly round, smooth, bearing few setae; discrimen extending 1/3 the length of structure; (44) prepectus favose mesally, smooth laterally; (45) mesepisterna setose, laterally favose with pattern centrally rugose, absent at discrimen; (46) mesepimera favose; (47) anapleurite rugose.

(48) Propodeum 4 times as wide as long, mesally rugose, laterally smooth; median longitudinal carina absent; (49) gaster ovoid, slightly larger than head and mesosoma combined; (50) terga lightly shagreened; posterior tergal margins strongly sinuate; (51) sterna coriaceous; (52) ovipositor and gonostylus 5 times gaster length; (53) gonostylus bearing small setae along mesal surface.

Male—Body length 1.2 mm. (54, 55) Head and mesosoma tan; (56) gaster white; (57) antenna, except segment 3, amber; (58) legs honey colored with tibial margins red.

(59) Head with small setae sparsely arranged over dorsal surface; clypeal margin strongly concave, without setae or spines; (60) mandible bidentate (Fig. 81), not scythe-like; (61) antenna (not figured) 5-segmented; (62) tarsi 5-segmented; tibiae (Figs. 89-91) without large apical spurs; basitarsi with few apical spurs; (63) terga asetose; posterior tergal margins sinuate; (64) sterna smooth, asetose.

Material—Described from 31 female and 14 male specimens collected by William Ramírez at Rio Aguilar, Hatillo, San José, Costa Rica on 14 June 1964 from *Ficus lapithifolia*. This species of fig is widespread in México and Central America.

Holotype—One dissected female mounted in Hoyer's medium on 2 slides under 5 coverslips. Each label is inscribed: "*Idarnes simus*. Rio Aguilar, Hatillo, Costa Rica. 14 June 1964, leg. W. Ramírez, ex. *Ficus lapithifolia*. HOLOTYPE."

Allotype—One dissected male mounted on 1 slide under 3 coverslips in the manner indicated above. *Paratypes*—Eight dissected females, slide mounted in the manner indicated for the holotype, with a similar label inscription.

Variation—In some females the face may be rugose at the level of the toruli and become progressively more favose towards the vertex (8), the entire pronotum may be shagreened (27), the mesosternum may be asetose (45, 46) or the anapleurite may be shagreened (47). Males exhibit some size variation, but appear remarkably constant morphologically. Occasionally, a male may have a mandible verging on scythe-like (60).

Comparative Comments—This wasp is easily recognized by the following combination of female characters: widely separated toruli (11), broad, flat interantennal ridge (13), flexible, blunt setae on each flagellomere (17), smooth frons bearing setae (19), straight clypeal margin (20), and mesopectus favose (44, 45, 46). Males have small setae on the head (59), bidentate mandible (60), and asetose terga (63).

SPECIES INCORRECTLY ATTRIBUTED TO *IDARNES*

The species listed below have at one time or another been placed in *Idarnes*, but this assignment is probably or certainly incorrect as explained in each case.

Idarnes australis Froggatt, 1900, Agr. Gazette N.S.W. 11:452, ♀.

The illustration of this species indicates the forewing lacks setal tracts and adstigmal setae, and the hindwing bears a fully developed marginal vein. Froggatt's description makes the species difficult to place, but it has been recognized by Mayr (1906) as *Sycoryctes australis*. It is an Australian species and for that reason alone unlikely to fall in *Idarnes* as that genus is here defined.

Otitesella gnaphalocarpae Risbec, 1951, Mém. Inst. Français d'Afr. Noire 13:332, ♀.

I have not had the opportunity to examine this species. Wiebes (1970) regards it as an *Idarnes* species. It was described from Senegal emerging from *Ficus gnaphalocarpa* and for these reasons probably does not belong to *Idarnes* as here restricted.

Idarnes gracilie Wiebes, 1968, Zool. Meded. 42:318, ♀.

Described from Africa, this species bears a strong resemblance to *Idarnes*. However, I consider the species extralimital not only because of its continent of origin but because: (1) the forewing lacks setal tracts; (2) the hindwing has a completely developed marginal vein; (3) the terminal segment of the maxillary palpus is not excindate; (4) an acuminate seta is found on the first maxillary palpal segment rather than at the base of the terminal one; and (5) as pictured, the female lacks the discoid sensillum on the base of the first palpal segment of the maxilla.

Idarnes nigra Risbec, 1951, Mém. Inst. Français d'Afr. Noire 13:123, ♀, ♂.

Wiebes (1970) examined Risbec's material and indicated that the females are probably *Sycoscapter* and the males *Apocrypta*. The continent of origin is sufficient to exclude the material from *Idarnes* as here defined.

Idarnes orientalis Walker, 1875, Entomologist 8:17, ♀.

I have not had the opportunity to examine the material. Walker indicated *I. orientalis* was recovered from Hindustan and Ceylon. On the basis of distribution it is excluded from *Idarnes* as here defined. Grandi (1928) considered *I. orientalis* a synonym of *Sycoscapter stabilis*.

Idarnes pteromaloides Walker, 1871, Notes on Chalcidiae 4:63, ♀.

Wiebes (1967) has considered the material as *Micransia pteromaloides* (Walker). The material described by Walker came from Hindustan, and hence is excluded from *Idarnes* in the present work.

Idarnes stabilis Walker, 1871, Notes on Chalcidiae 4:62, ♀.

Wiebes (1967) has demonstrated that *I. stabilis* is *Sycoscapter stabilis* (Walker). The original material came from India and is also excluded from *Idarnes* on the basis of distribution.

Idarnomorpha subaenea Girault, 1915, Mem. Queensland Mus. 4:282, ♀, ♂.
Idarnes subaenea Girault, 1917, Insec. Inscit. Menstr. 5:37, ♀.

Girault (1917) considered *Idarnomorpha* to be synonymous with *Idarnes;* thus the Australian species *subaenea* was transferred to *Idarnes.* Girault considered the antenna 13-segmented, counting the terminal protuberance as a distinct segment. Girault indicates the female is 1.75 mm and the male is 2.8 mm long. In all described species of *Idarnes,* the female is larger than the male. If the sexes are correctly associated, a typographical error has probably been made. Assuming the sexes to be correctly associated, *Idarnes subaenea* must be considered extra-limital both geographically and morphologically. *Idarnomorpha* is probably a good genus on the basis of the male antenna being 3- and tarsi 5-segmented. The wasps were reared from figs with *Ceratosolensis ficophaga* Girault. *Idarnes* has been shown in all other instances to parasitize tropical American *Blastophaga*; hence, biological information also suggests that *Idarnomorpha* is a valid genus.

Idarnes transiens Walker, 1871, Notes on Chalcidiae 4:62, ♀.

Idarnes transiens was described from the female from Ceylon and India. Morphologically, the species is clearly not *Idarnes,* and Wiebes (1967) has called it *Philotrypesis transiens.*

Tetragonaspis testacea Mayr, 1885, Verh. Zool. Bot. Gesell. Wien 35:157, ♀.
Eukoebelea testacea Mayr, 1906, Wien. Ent. Ztg. 25:165, ♀.
Sycophagella agraensis Joseph, 1953, Agra Univ. J. Sci. 2:54, ♀, ♂.
Idarnes testacea (Mayr), Joseph, 1956, Ann. Soc. Ent. Fr. 125:103, ♀, ♂.

Illustrations do not accompany the original description of *Tetragonaspis testacea.* Joseph (1953) described *Sycophagella agraensis* from the receptacles of *Ficus glomerata* collected in India and illustrated the female. In 1956, he considered *S. agraensis* synonymous with *Idarnes testacea* (Mayr). If Joseph's description is correct, and if he has correctly associated *S. agraensis* with *T. testacea,* then this material cannot be considered *Idarnes* for the following reasons: (1) the maxillary palpus is unisegmented; (2) the forewing lacks a parastigmal notch and sensilla; (3) the forewing lacks setal tracts; and (4) the hindwing bears a fully developed marginal vein. Geographically, also, this species is outside the known range of *Idarnes* as here delimited.

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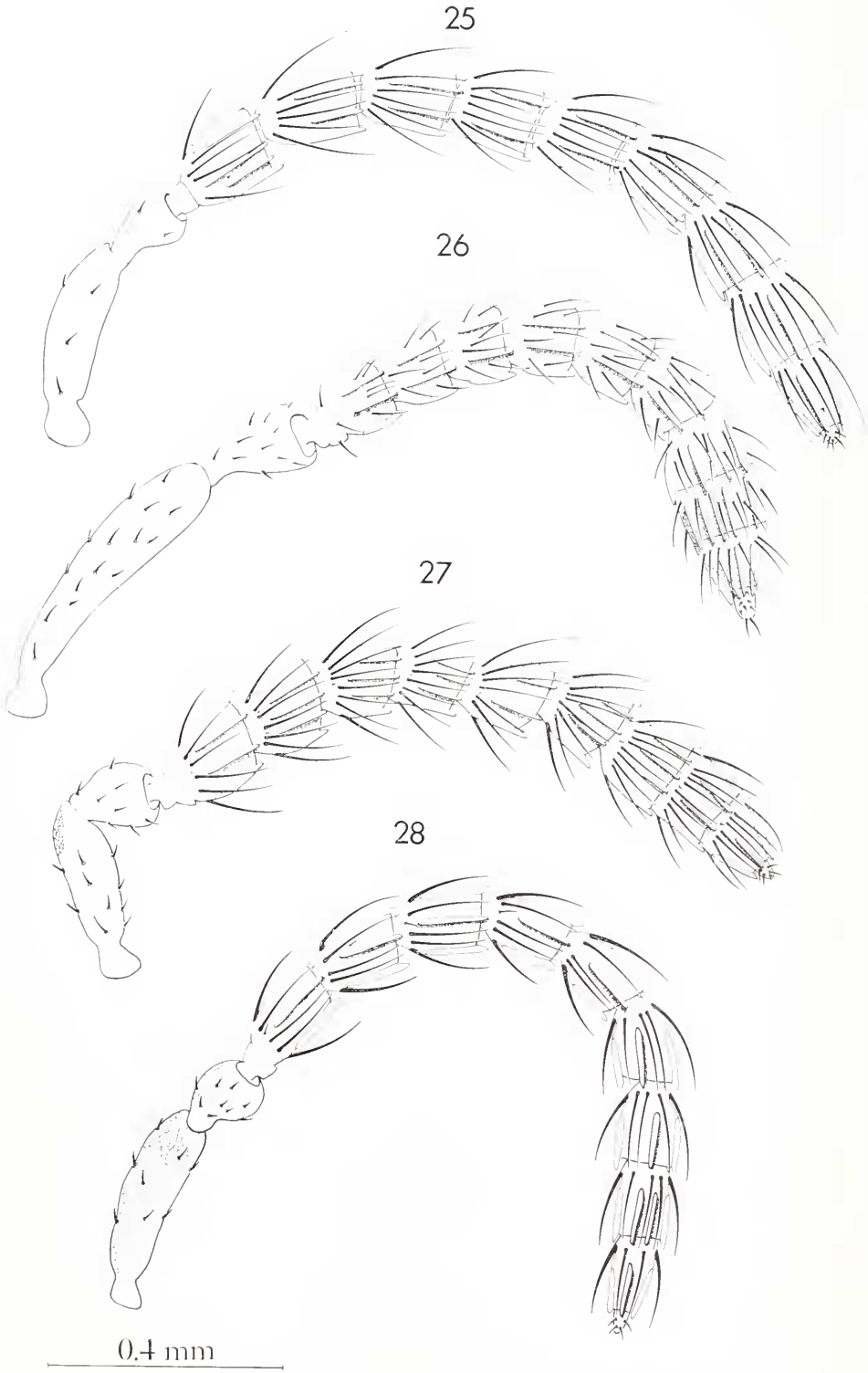
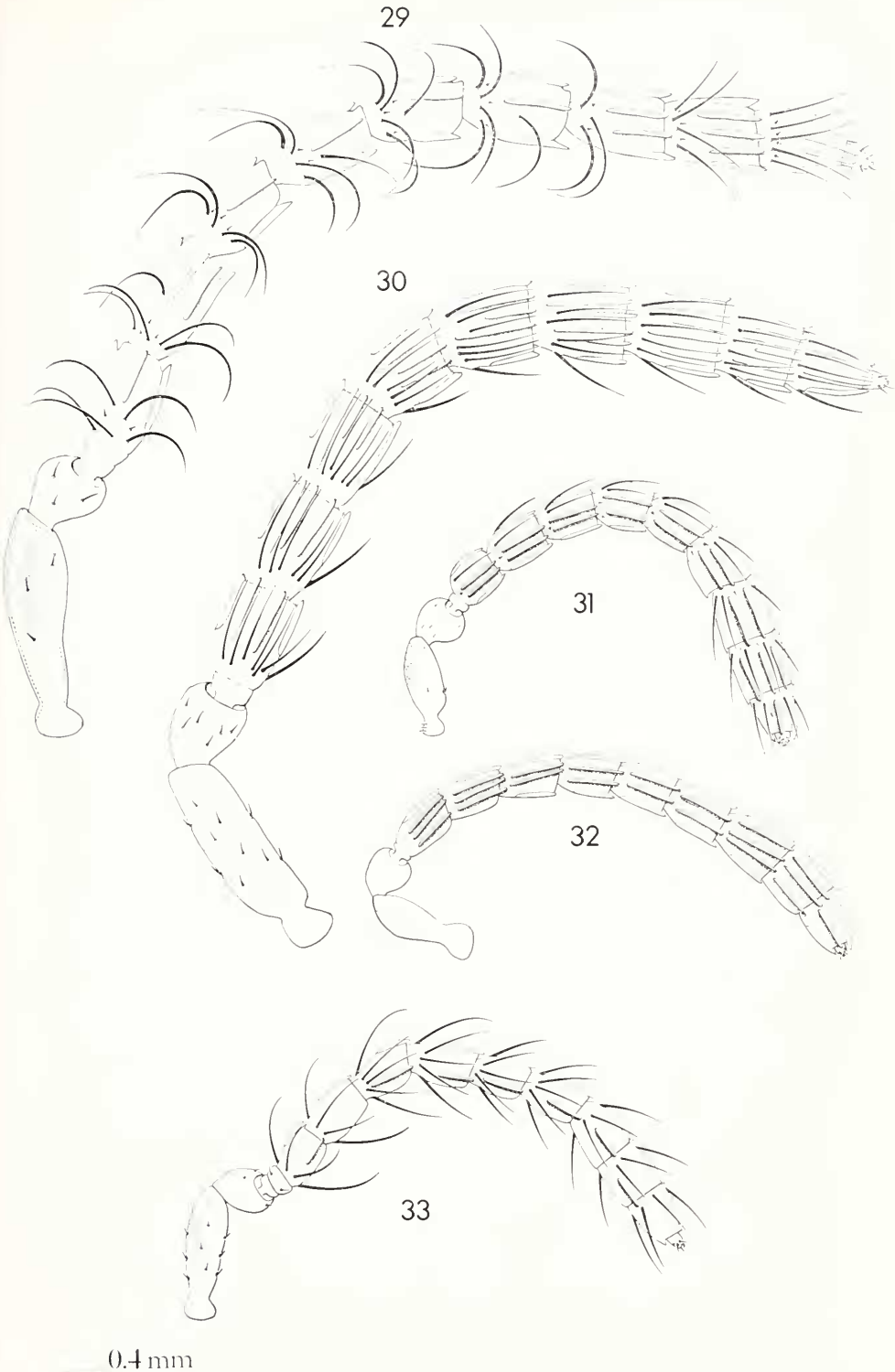
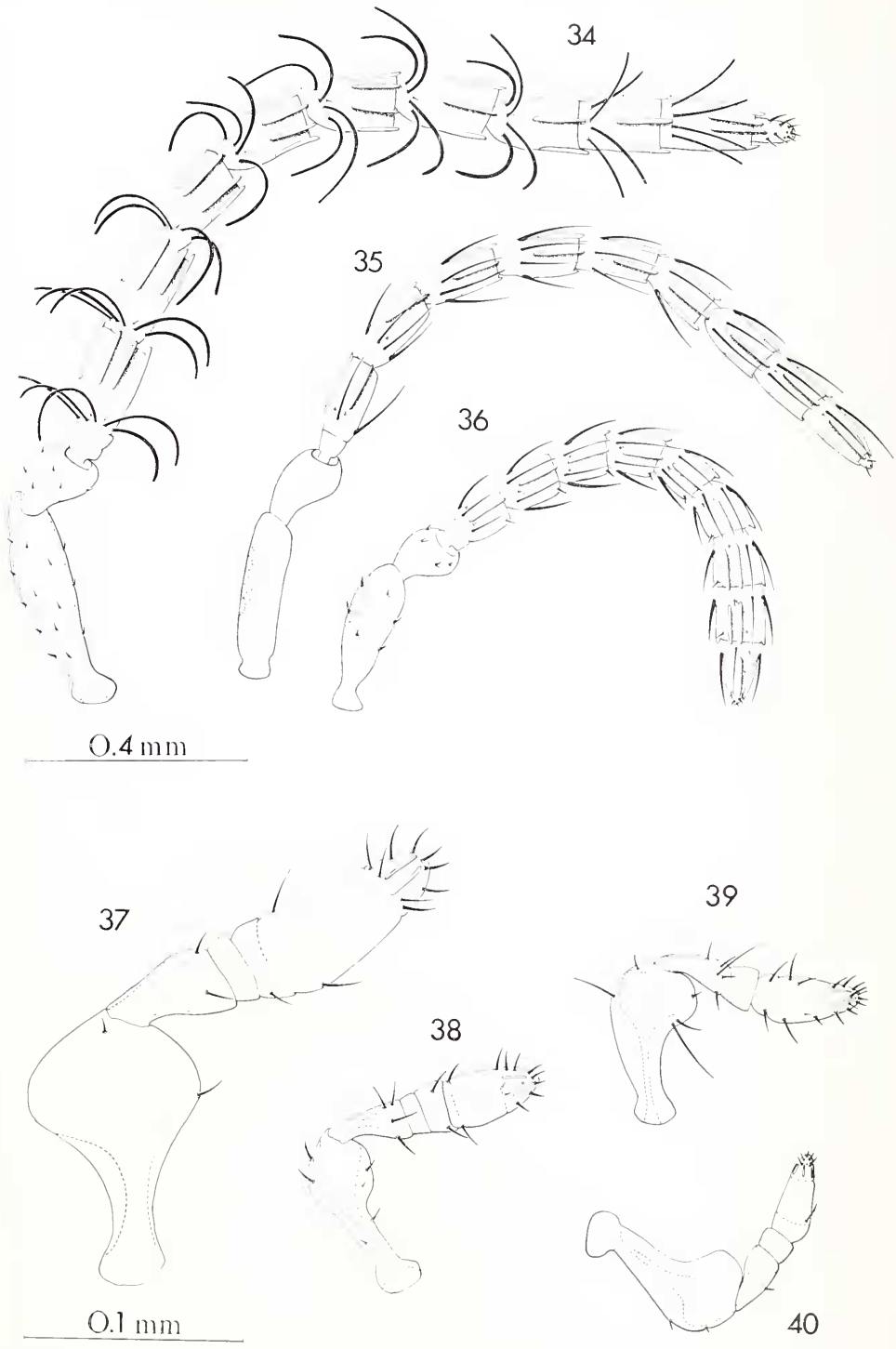


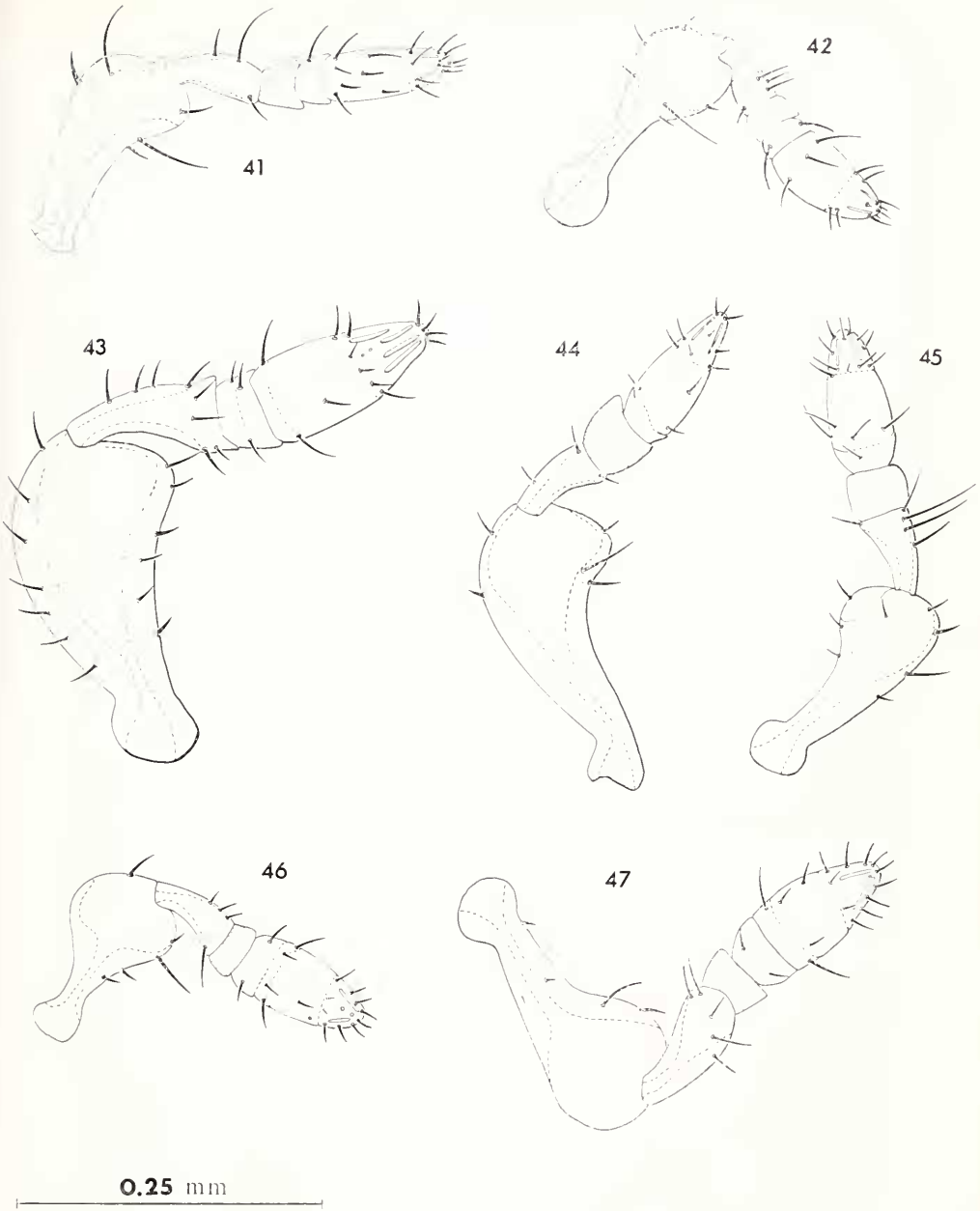
FIGS. 25-28. Left antenna of *Idarnes* females, inner aspect. **25**, *I. barbigera*; **26**, *I. bucatoma*; **27**, *I. micheneri*; **28**, *I. ashlocki*.



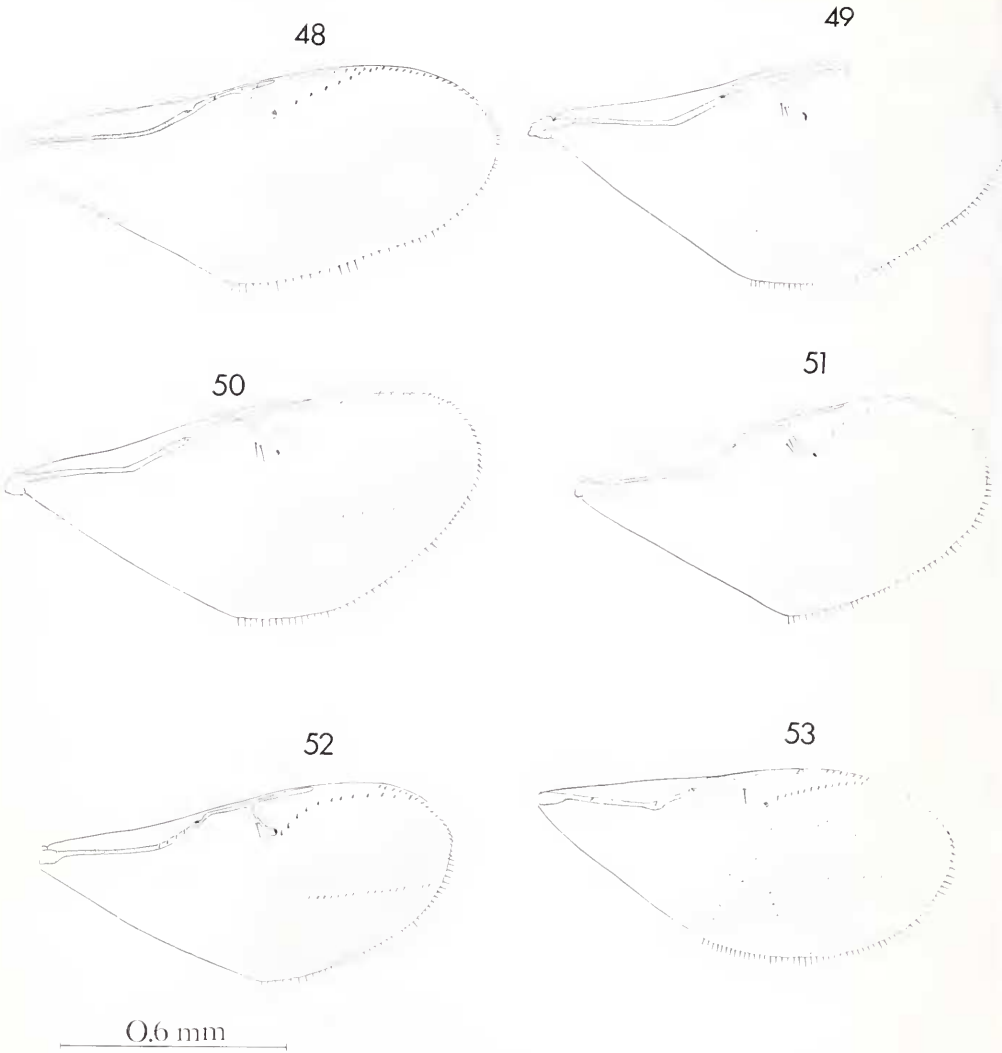
Figs. 29-33. Left antenna of *Idarnes* females, inner aspect. **29**, *I. flavicollis;* **30**, *I. obtusifoliae;* **31**, *I. galbina;* **32**, *I. carme;* **33**, *I. camini.*



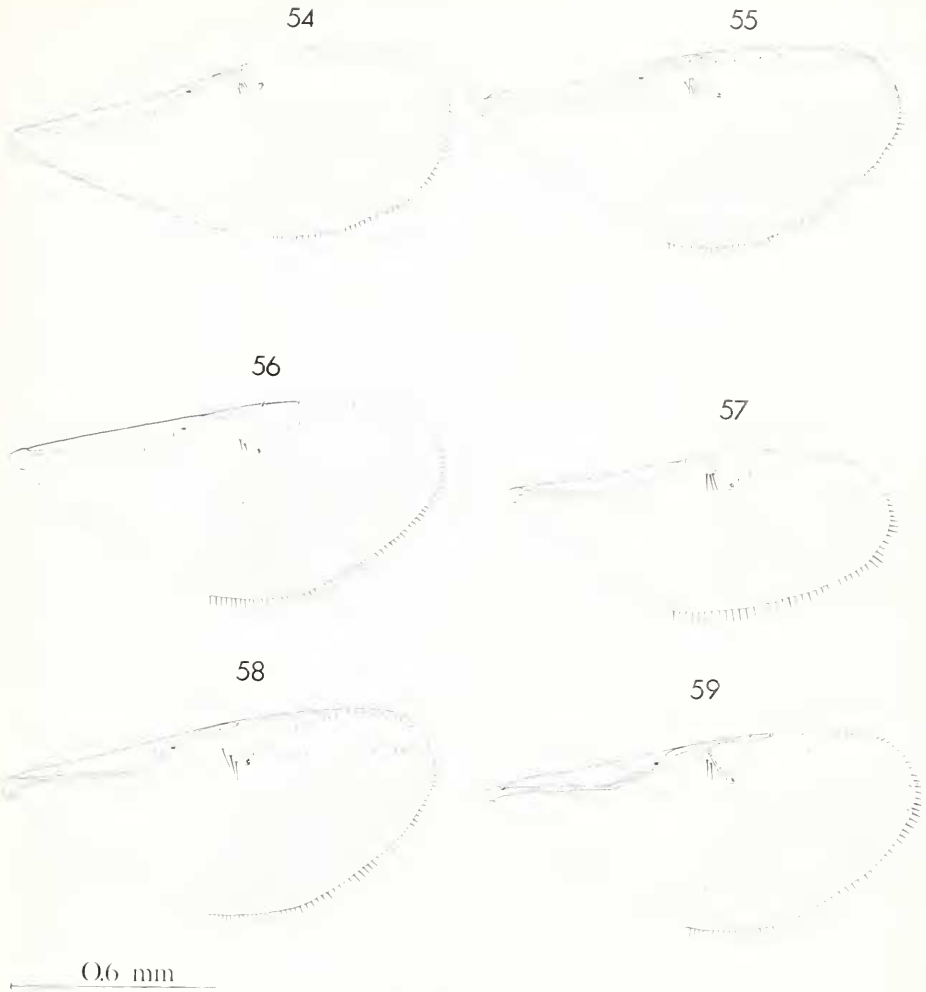
FIGS. 34-40. Left antenna of *Idarnes* females (34-36) and males (37-39), inner aspect; right antenna, male, dorsal aspect (40). **34,** *I. simus;* **35,** *I. oscrocata;* **36,** *I. jimenezi;* **37,** *I. galbina;* **38,** *I. camini;* **39,** *I. ashlocki;* **40,** *I. carme.*



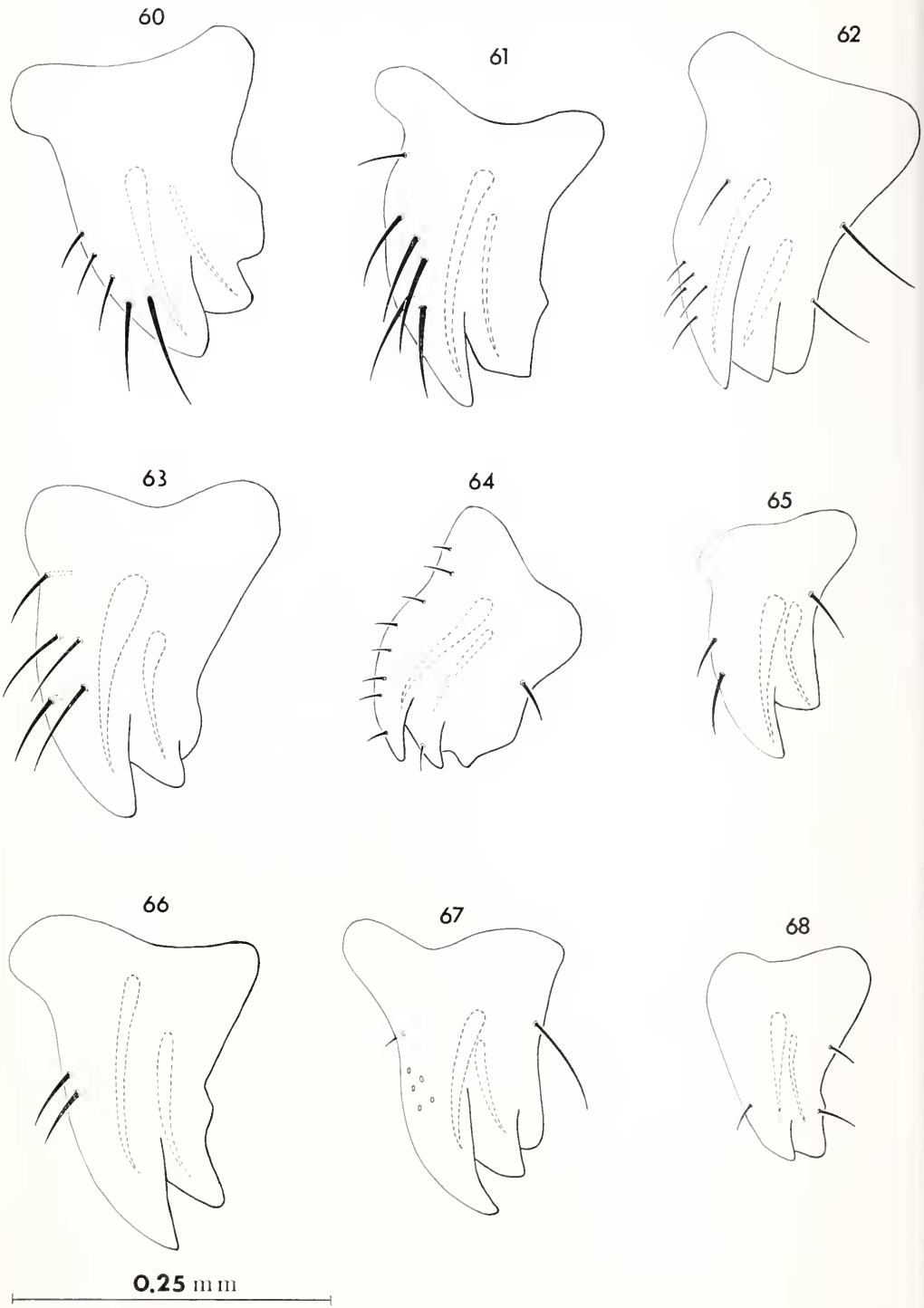
Figs. 41-47. Antennae of *Idarnes* males, dorsal aspect; 45, 47 right antenna, remainder left. **41,** *I. jimenezi;* **42,** *I. oscrocata;* **43,** *I. bucatoma;* **44,** *I. barbigera;* **45,** *I. obtusifoliae;* **46,** *I. micheneri;* **47,** *I. flaticollis.*



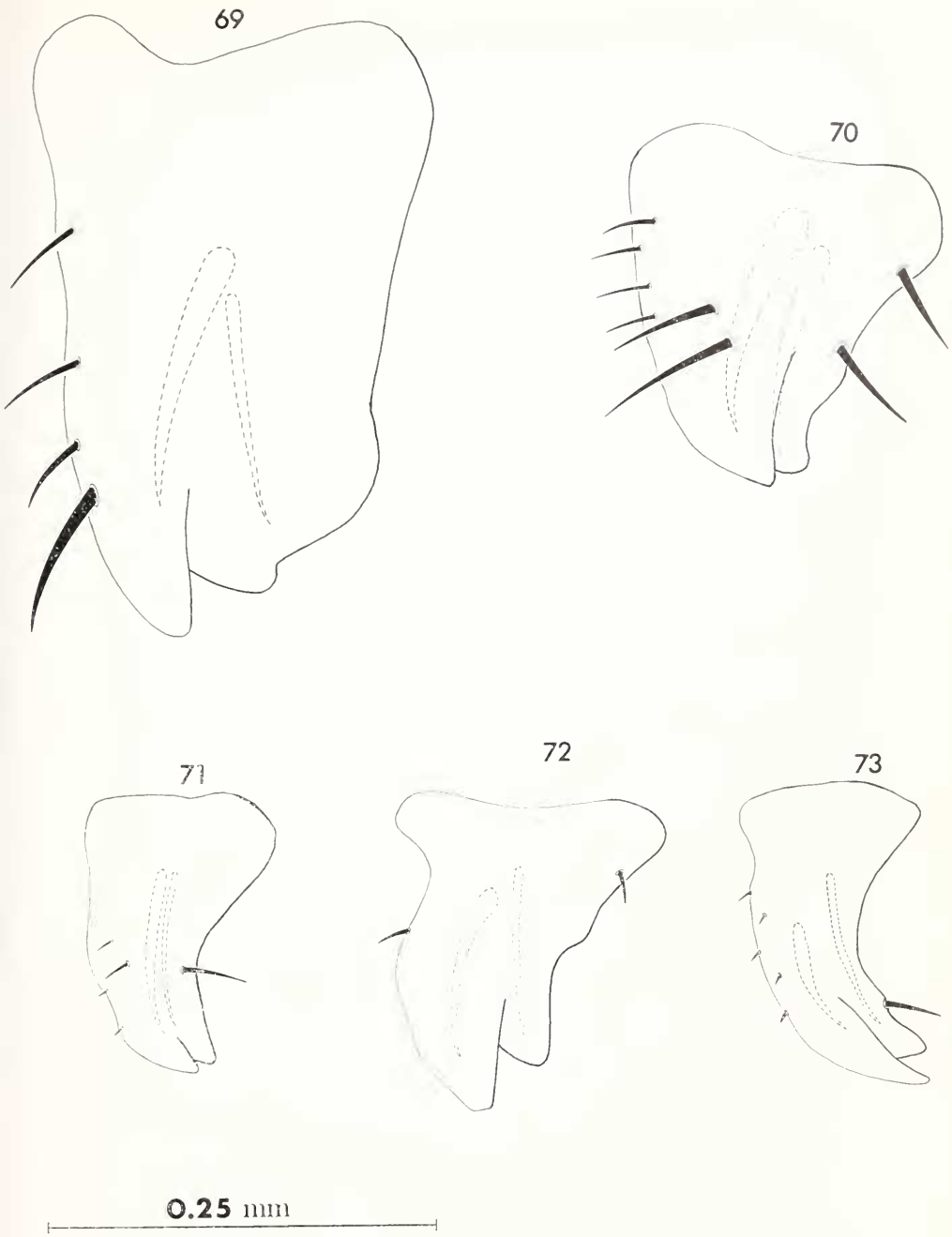
FIGS. 48-53. Right forewing of *Idarnes* females. **48**, *I. flavicollis;* **49**, *I. simus;* **50**, *I. galbina;* **51**, *I. ashlocki;* **52**, *I. obtusifoliae;* **53**, *I. carme.*



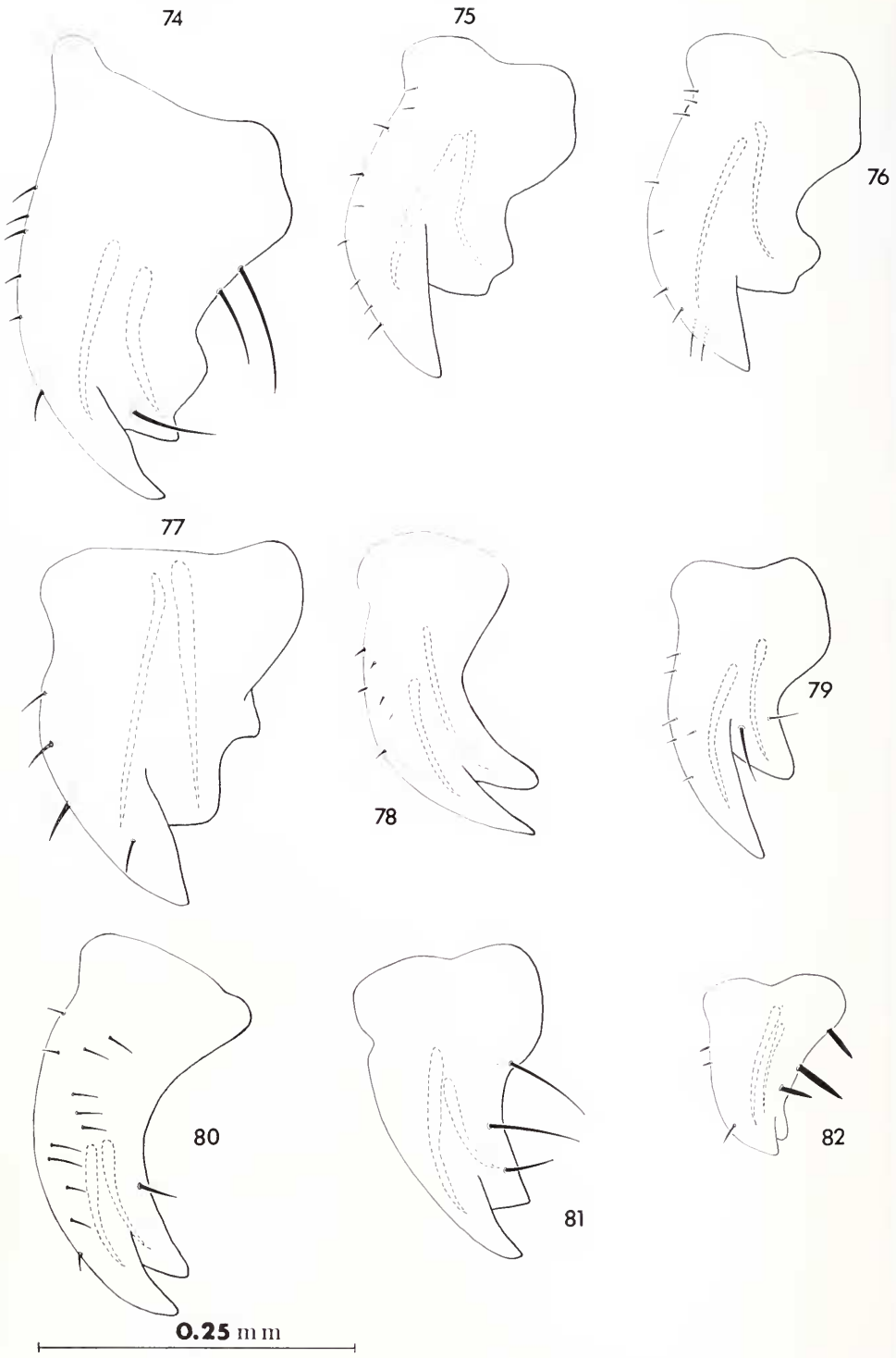
Figs. 54-59. Right forewing of *Idarnes* females. **54,** *I. bucatoma;* **55,** *I. camini;* **56,** *I. barbigera;* **57,** *I. oscrocata;* **58,** *I. michaeneri;* **59,** *I. jimenezi.*



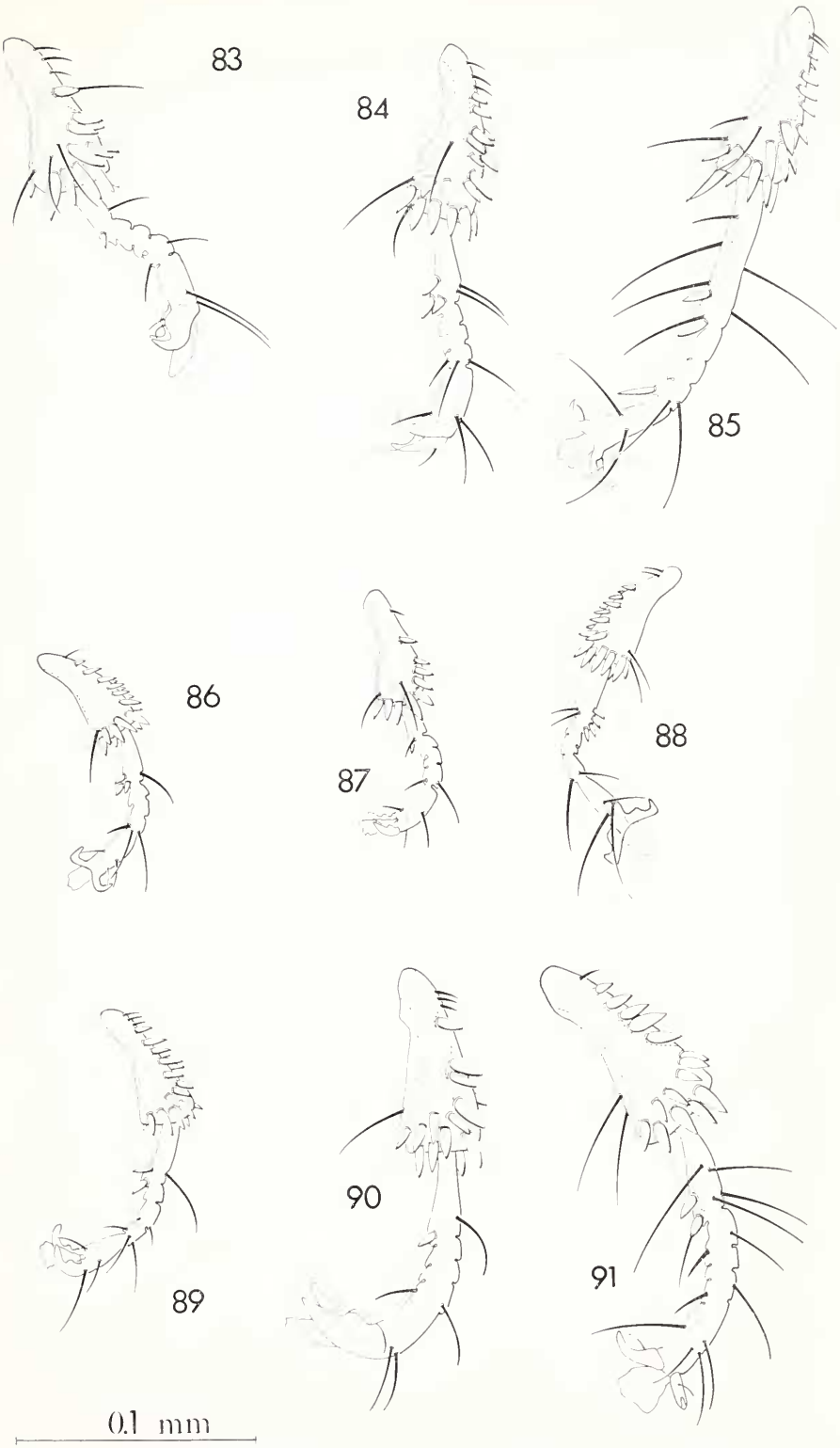
FIGS. 60-68. Right mandible of *Idarnes* females, inner aspect. **60**, *I. micheneri;* **61**, *I. barbigera;* **62**, *I. obtusifoliae;* **63**, *I. ashlocki;* **64**, *I. bucatoma;* **65**, *I. jimenezi;* **66**, *I. oscrocata;* **67**, *I. camini;* 68, *I. galbina.*



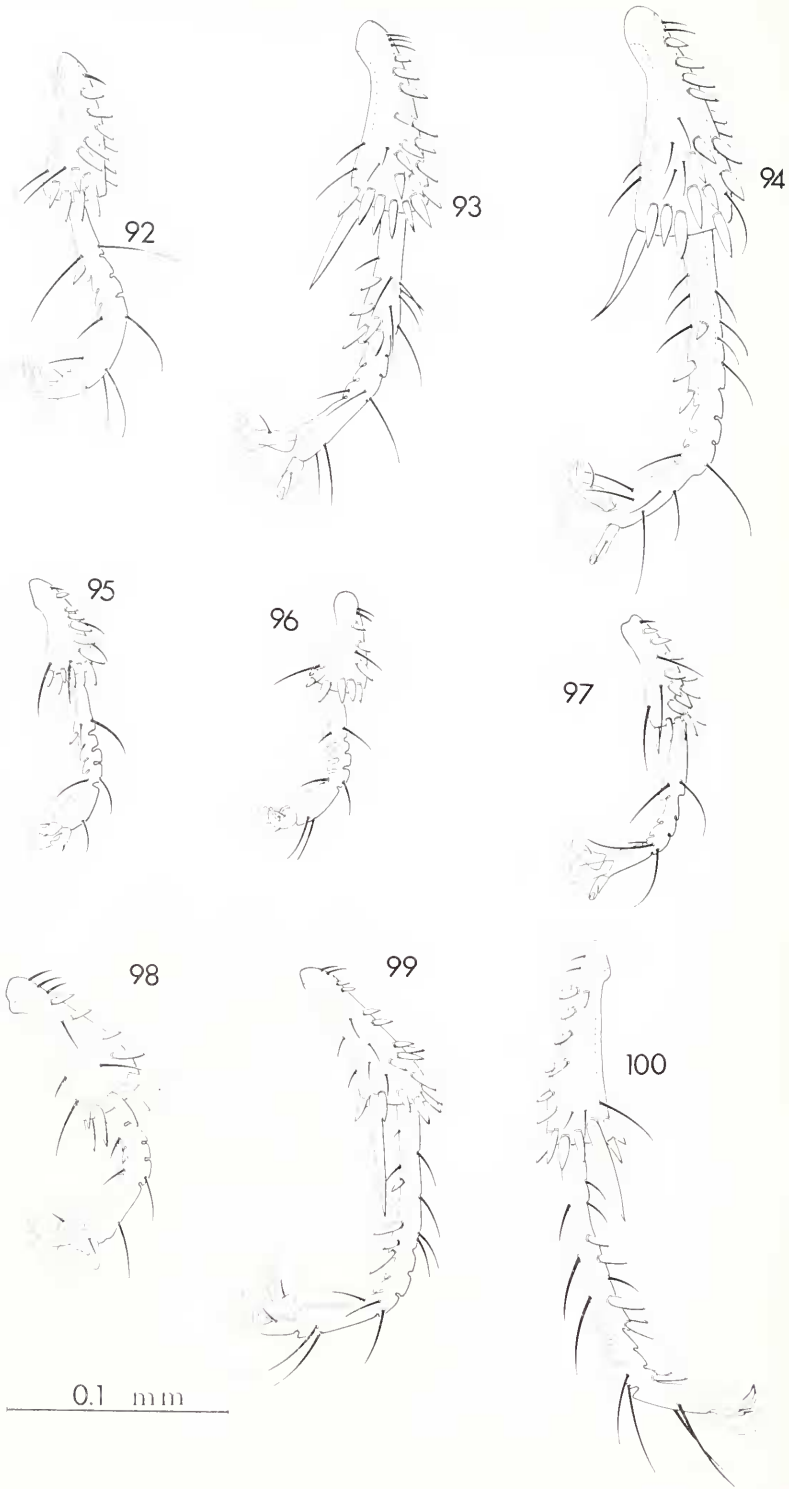
Figs. 69-73. Right mandible of *Idarnes* females (69, 72) and males (70, 71, 73), inner aspect. **69**, *I. flavicollis*; **70**, *I. obtusifoliae*; **71**, *I. ashlocki*; **72**, *I. carme*; **73**, *I. carme*.



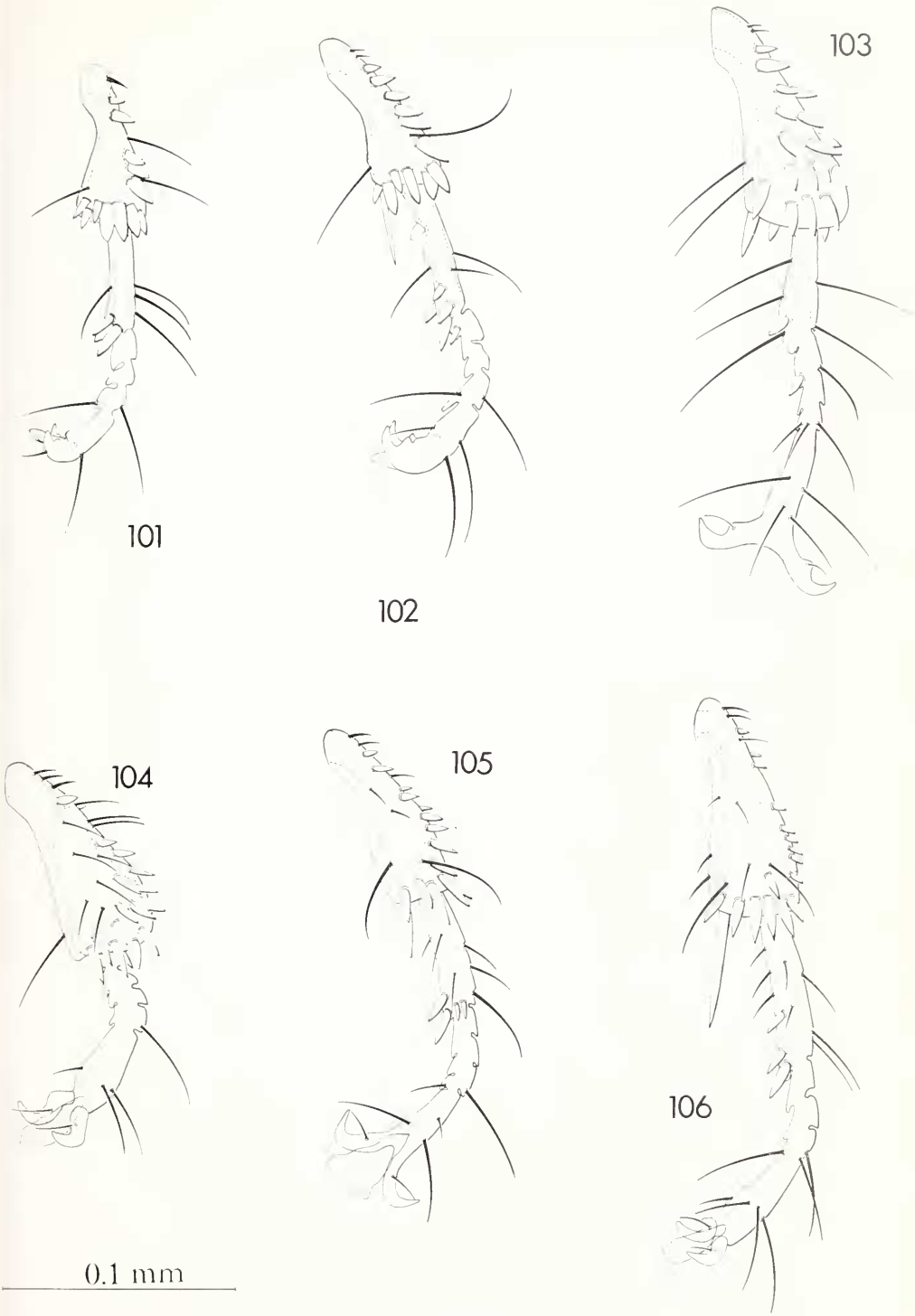
FIGS. 74-82. Right mandible of *Idarnes* males, inner aspect. **74**, *I. bucatoma;* **75**, *I. flavicollis;* **76**, *I. micheneri;* **77**, *I. galbina;* **78**, *I. jimenezi;* **79**, *I. camini;* **80**, *I. barbigera;* **81**, *I. simus;* 82, *I. oscrocata.*



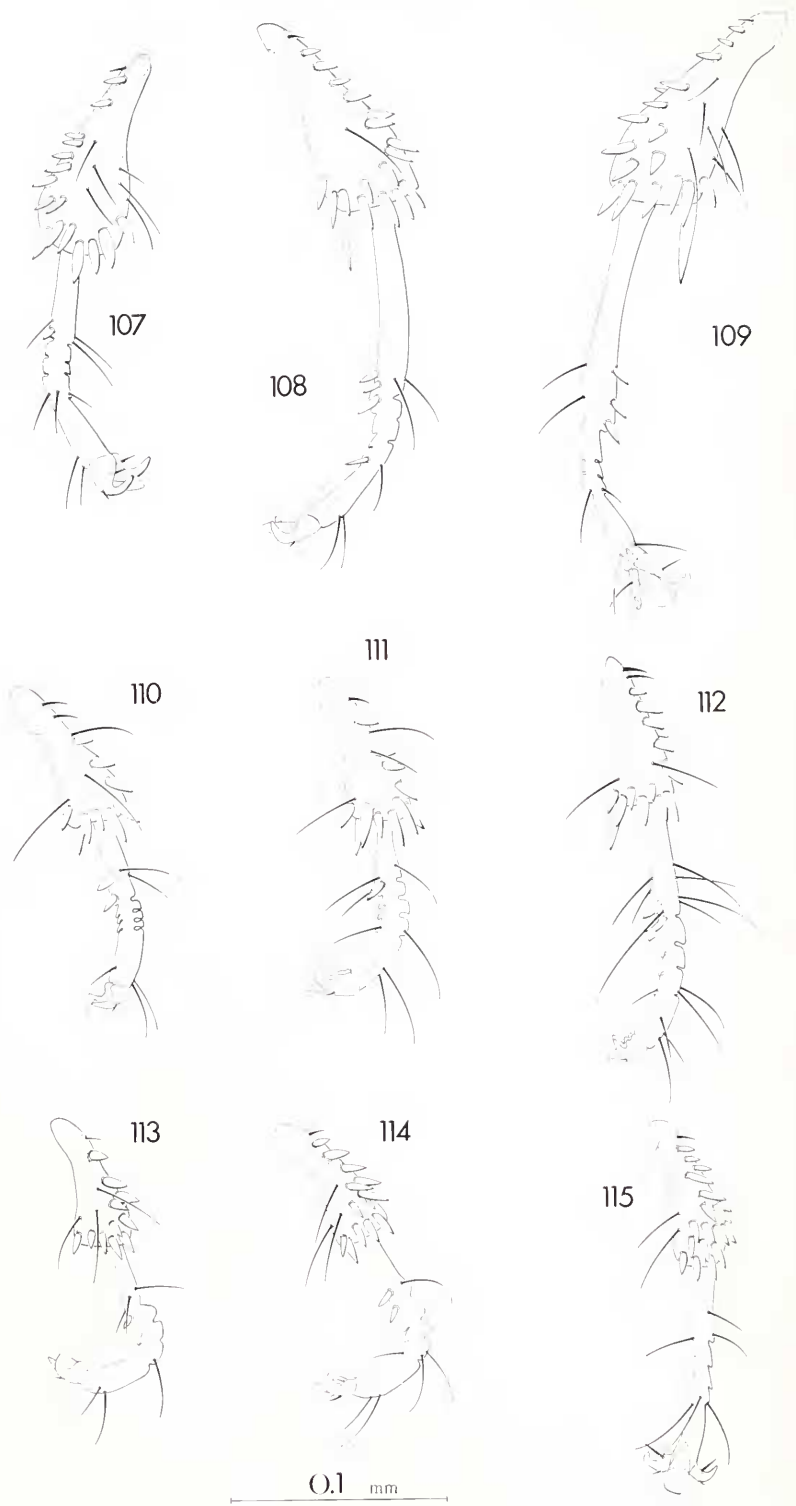
Figs. 83-91. Fore, middle and hind tibiotarsi of *Idarnes* males, inner aspect. 83-85, *I. ashlocki;* 86-88, *I. galbina;* 89-91, *I. simus.*



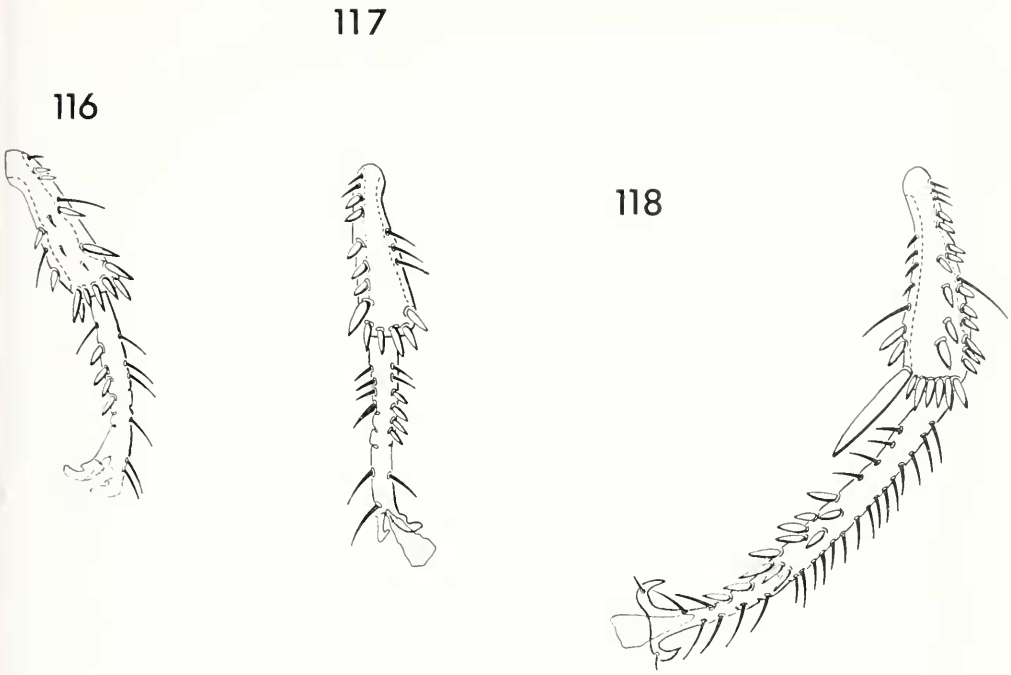
FIGS. 92-100. Fore, middle and hind tibiotarsi of *Idarnes* males, inner aspect. **92-94**, *I. flavicollis;* **95-97**, *I. carme;* **98-100**, *I. camini.*



Figs. 101-106. Fore, middle and hind tibiotarsi of *Idarnes* males, inner aspect. **101-103**, *I. obtusifoliae*; **104-106**, *I. michenen.*



FIGS. 107-115. Fore, middle and hind tibiotarsi of *Idarnes* males, inner aspect. **107-109,** *I. barbigera;* **110-112,** *I. jimenezi;* **113-115,** *I. oscrocata.*



Figs. 116-118. Fore, middle and hind tibiotarsi of *Idarnes bucatoma* male, inner aspect. (Hind tibiotarsus = 0.2 mm.)